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PHYSICS ABSTRACTS

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SECTION A OF SCIENCE ABSTRACTS

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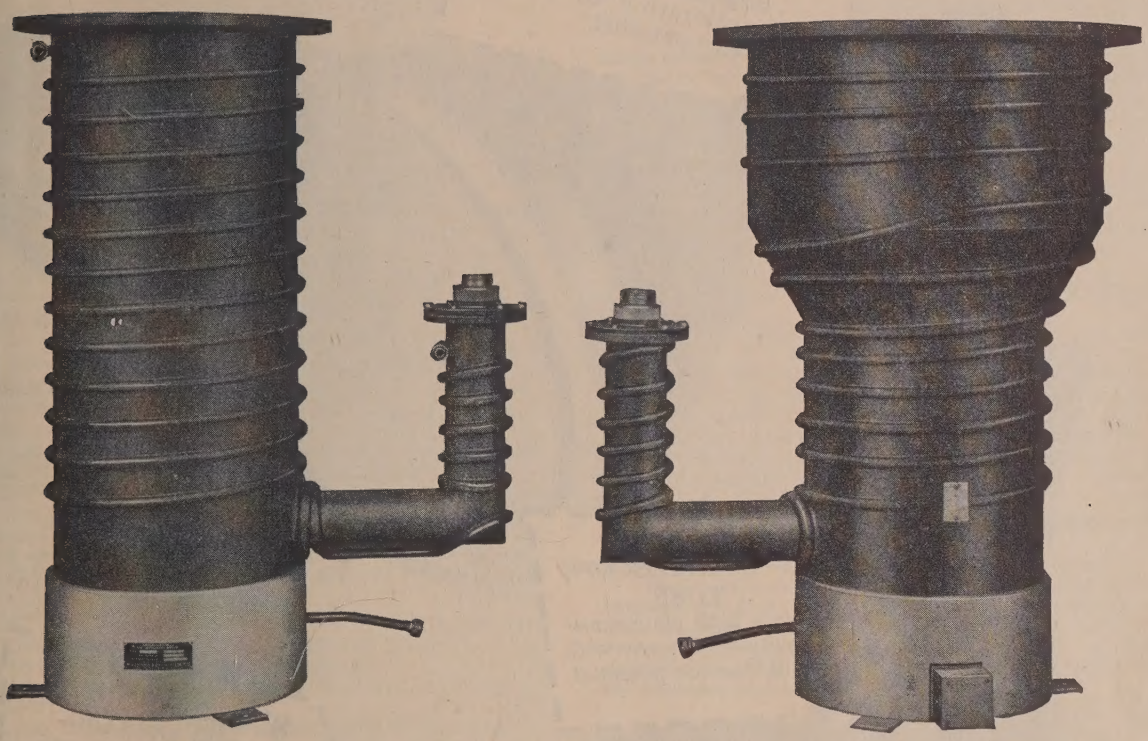

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PHYSICS ABSTRACTS

Volume 61 OCTOBER 1958 Number 730

ASTRONOMY . ASTROPHYSICS

522.21 : 535.312 : 535.833

SOME CONSIDERATIONS ON AN APLANATIC REFLECTING TELESCOPE. See Abstr. 5829

522.61 : 771.534

6573. THEORETICAL CONSIDERATIONS REGARDING THE CHOICE OF PHOTOGRAPHIC PLATES FOR SPECTROPHOTOMETRY. A.Kranjc.
Mem. Soc. Astron. Ital., Vol. 28, No. 1-2, 95-103 (1957). In Italian.

Deduces, on theoretical grounds, a diagram which facilitates the selection of the most suitable type of photographic emulsion, and the best width and height of slit, for obtaining the maximum amount of information with a given exposure. The practical application to the spectrophotometry of stars is explained. J.W.T.Walsh

522.615

6574. A VERY SENSITIVE PHOTOELECTRIC POLARIMETER FOR SOLAR STUDIES. A.Dollfus.
C.R. Acad. Sci. (Paris), Vol. 246, No. 16, 2345-7 (April 21, 1958). In French.

The instrument incorporates a twin-cell balanced-circuit with modulator and amplifier units, based on Lyot's original design (Abstr. 2659-60/1948). Cell sensitivity (110 μA/m) is such that reliable measurements of polarization can be made over a wide range of flux values (10^3-10^{-4} μlm). The apparatus may thus be used to compare very weak polarization components, and to detect a very small rotation of the plane of polarization of the order of a few seconds of arc. D.R.Barber

522.615 : 535.242.6

6575. THE STELLAR PHOTOMETER OF THE DOMINION ASTROPHYSICAL OBSERVATORY. P.E.Argyle.
Publ. Dominion Astrophys. Obs. Victoria, B.C., Vol. 10, No. 14, 305-21 (1957).

A multi-colour photoelectric stellar photometer using an E.M.I. 6094 photomultiplier tube was constructed and fitted to the Cassegrainian focus of the 72 in. telescope. Deflections are recorded on a Brown strip-chart recorder. The photometer has performed well down to the magnitude limit of visual guiding. The optical and electrical design of the photometer is described in detail and its performance is illustrated by means of some results obtained by observation of the faint eclipsing binary UX Ursae Majoris.

A.

522.615

6576. THE INTEGRATING EXPOSURE METER OF THE DOMINION ASTROPHYSICAL OBSERVATORY.
J.B.Warren and P.E.Argyle.
Publ. Dominion Astrophys. Obs. Victoria, B.C., Vol. 10, No. 15, 323-30 (1957).

A photoelectric exposure meter of the integrating type was built and installed on the spectrograph of the 72 in. telescope. The meter utilizes an E.M.I. type 6094 photomultiplier tube and a high-gain d.c. feedback amplifier. Integration is by repeated charging of a low-leakage capacitor, the number of chargings being indicated by a mechanical register. The device uses 5% of the starlight entering the spectrograph and operates reliably on stars brighter than the 11th magnitude. A.

522.9

6577. DEFORMABLE OPTICAL ELEMENTS WITH FEEDBACK.
H.W.Babcock.
J. Opt. Soc. Amer., Vol. 48, No. 7, 500 (July, 1958).

Astronomical observations are seriously limited by the enlargement and continual random-wandering of telescopic images, which, together with scintillation, constitute what is called "seeing". No practicable method has yet been either demonstrated or proposed in detail, and it has been pointed out that even the removal of phase errors from the instantaneous wave-fronts would still leave the image spread due to amplitude errors, and might therefore only give a moderate improvement in image sharpness. The author proposes a method of correcting the phase errors caused by atmospheric inhomogeneity in the light received from astronomical sources. The principle would be the deformation of a thin-film mirror by electrostatic forces under the control of an electronic beam.

A.Beer

523.11 : 523.164.4

MODEL UNIVERSES DERIVED FROM COUNTS OF VERY DISTANT RADIO SOURCES. See Abstr. 6587

523.162

6578. REMARKS ON POLARIZATION IN THE H II MEDIUM.
S.Grzedzielski.
C.R. Acad. Sci. (Paris), Vol. 246, No. 6, 890-3 (Feb. 10, 1958). In French.

The turbulence of interstellar matter causes considerable exchange of material between the H I clouds and the ionized H II medium. An examination of the equilibrium conditions leads to the conclusion that, assuming the Davis—Greenstein mechanism, an important fraction of the observed polarization is produced in the ionized H II medium. M.W.Ovenden

523.164.3

6579. POLARIZATION OF COSMIC RADIO-EMISSION ON 1.45 AND 3.3 m. V.A.Razin.
Astron. Zh., Vol. 35, No. 2, 241-52 (1958). In Russian.

The intensity of the linearly-polarized component of the emission on 1.45 m, in directions whose galactic latitudes are $> 5^0$, was found to be 2^0-4^0 K. In the case of the emission on 3.3 m the intensity was found to be smaller by a factor of 4-5. Two methods were used: modulated transmission bandwidth (1.45 m) and frequency modulation (3.3 m). S.Chomet

523.164.32 : 523.164.42

6580. ON THE DIFFRACTION OF RADIO-WAVES BY RANDOM IRREGULARITIES AND INTENSITY FLUCTUATIONS IN THE SOLAR AND COSMIC RADIO EMISSION. V.V.Pisareva.
Astron. Zh., Vol. 35, No. 1, 112-28 (1958). In Russian.

A detailed mathematical analysis is given of the intensity fluctuations which occur when a spherical electromagnetic wave passes through a layer of random irregularities in the refractive index. Expressions are given for the auto-correlation function and the mean square of the fluctuations. The present results differ from those of other workers only in the case of a very disturbed wave. The theory is applied to propagation of radio-waves in a non-uniform solar corona. It is shown that it may be possible to explain the intensity fluctuations in the radio emission from the discrete source Hydra A by diffraction of radio-waves on irregularities in the interstellar and interplanetary ionized gas. S.Chomet

523.164.32

6581. STUDIES OF PERSISTENT SOLAR SOURCES OF CENTIMETRIC RADIATION. M.R.Kundu.
C.R. Acad. Sci. (Paris), Vol. 246, No. 19, 2740-3 (May 12, 1958). In French.

The brightness distribution across long-living solar sources of centimetric radiation was measured. Some of the sources are small (diameters ~ 1.5') and intense, others less intense and more extended. The occurrence of the small sources appears to be connected with periods of solar flare activity. M.W.Ovenden

523.164.32

6582. THE DIMENSIONS OF THE SOURCES OF SOLAR BURSTS ON CENTIMETRIC WAVELENGTHS. M.R.Kundu.
C.R. Acad. Sci. (Paris), Vol. 246, No. 20, 2852-5 (May 19, 1958). In French.

Sources are classified according to the characteristics of the bursts they produce. Diameters of the sources were measured

interferometrically, and a relationship was found between diameter and maximum intensity. The changing of the dimensions of some sources was followed, and equivalent temperatures were estimated. To some extent, both diameter and equivalent temperature of a source are related to the type of associated burst.

M.W.Ovenden

523.164.34

6583. RADIO EMISSION OF THE MOON IN THE 8 MILLIMETER BAND. A.E.Salomonovich.
Astron Zh., Vol. 35, No. 1, 129-36 (1958). In Russian.

Measurement were carried out during 1955/56 using a radio telescope incorporating a parabolic reflector 2 m in diamater. The signal-to-noise ratio was about 20. It was established that the mean temperature of the radiation depends on the phase of the moon and may be approximately represented by

$$T_C = 197 - 32 \cos(\theta - 40)\ [^\circ K],$$

where θ is the phase in degrees measured from the new moon.

S.Chomet

523.164.42 : 525.3 : 621.396.946

THEORETICAL ANALYSIS OF DOPPLER RADIO SIGNALS FROM EARTH SATELLITES. See Abstr. 5594

523.164.4

6584. RADIO SOURCES OUTSIDE OUR GALAXY. I. SYDNEY INVESTIGATIONS AND VERY DISTANT RADIO SOURCES. J.L.Pawsey.
Publ. Astron. Soc. Pacific, Vol. 70, 133-40 (April, 1958).

Model experiments were made in the laboratory, with the help of an electronic computer, on the effects of passing an aerial beam across an artificial sky. Specimen results are presented, illustrating the danger of misinterpreting as single sources the effects of random clusters of faint sources. The "danger level" for appreciable blending was found to be about 1 source per 15 beam areas. The Sydney pencil-beam survey (which gave no significant excess of faint sources over the uniform Euclidian distribution) just avoids this limit, whereas the Cambridge interferometer surveys deal with source densities considerably in excess of the danger limit. It is therefore suggested that the excess of faint sources reported from the Cambridge surveys is a result of blending, and is not a real effect.

M.W.Ovenden

523.164.4

6585. RADIO SOURCES OUTSIDE OUR GALAXY. II. THE DISTRIBUTION OF RADIO STARS. A.Hewish.
Publ. Astron. Soc. Pacific, Vol. 70, 140-3 (April, 1958).

It is pointed out: (a) that there are discrepancies between the Cambridge and Sydney observations of individual sources that cannot be explained as arising from errors due to limited resolving power; and (b) that the main argument, from the Cambridge observations, leading to an excess of faint sources is a statistical one that is entirely free from blending errors. The finite angular dimensions of nearby (strong) sources might lead to an apparent deficit of more intense sources, but cannot account for the consistent departure of the results from the expectations of a uniform-density model.

M.W.Ovenden

523.164.4

6586. RADIO SOURCES OUTSIDE OUR GALAXY. III. THE PROBLEM OF THE IDENTIFICATION OF EXTRAGALACTIC RADIO SOURCES. R.Minkowski.
Publ. Astron. Soc. Pacific, Vol. 70, 143-51 (April, 1958).

A general discussion of the difficulties of correlating radio sources with optically-visible objects. A list of 6 certain, 2 probable and 3 possible identifications of radio sources with extragalactic nebulae is given. The present accuracy of radio positions does not permit any object whose apparent photographic magnitude $m_p > +17$ to be considered as an identification. The identified radio sources differ greatly in intrinsic strength, measured by the radio modulus $m_r - m_p$, where m_r is a conventional apparent radio magnitude. While objects of the intrinsic strength of the Cygnus A source may be visible as radio sources while invisible optically (with $m_p > +24$), the identified objects are likely to be intrinsically weak radio emitters. There is some evidence for a correlation between the importance of the spiral arms in a galaxy (observed optically) and the value of $m_r - m_p$.

M.W.Ovenden

523.164.4 : 523.11

6587. RADIO SOURCES OUTSIDE OUR GALAXY. IV. MODEL UNIVERSES DERIVED FROM COUNTS OF VERY DISTANT RADIO SOURCES. G.C.McVittie.
Publ. Astron. Soc. Pacific, Vol. 70, 152-9 (April, 1958).

Assuming a uniform expanding model universe, and a uniform distribution of radio sources with no dispersion in radio emission at any given cosmic time, although a possible change of radio emission with cosmic time, there is a class of model universe for which the number of sources in a given area of the celestial sphere, N, with flux density not less than S, is given by

$$\log N = A - \tfrac{3}{2}\log(S/S_S) - 1.3(1 + b_1)(S_S/S)^{1/2}\,\delta_S,$$

where S_S, δ_S are respectively the flux density and optical red-shift of a source chosen as standard. It should be noted that, should the constant b_1 happen to be -1, the formula reduces to the $\frac{3}{2}$ law of a static Euclidian universe. Thus the fitting of a set of data to a simple $\frac{3}{2}$ law is insufficient to prove that the sources are at rest in a Euclidian space. The Sydney survey results are discussed, taking various identified sources as standard, and can be plausibly interpreted provided that the standard source is no more powerful than NGC 1275. The Cambridge survey implies great secular changes of radiative strength in an acute form even for a standard source as weak as NGC 1275.

M.W.Ovenden

523.164.43

6588. AN INVESTIGATION OF THE RADIO EMISSION OF THE GALACTIC CENTRE AT $\lambda = 91.6$ cm. K.S.Stankevich.
Astron. Zh., Vol. 35, No. 1, 157-9 (1958). In Russian.

An unsuccessful attempt to detect the radio emission of interstellar deuterium using an 8 m paraboloid is described. It is estimated that the upper limit of deuterium concentration is 10^{-3} atoms/cm^3.

S.Chomet

523.5 : 523.164.3

6589. RADIO NOISE FROM METEORS. G.S.Hawkins.
Nature (London), Vol. 181, 1610 (June 7, 1958).

Using magnetometer-type recording equipment, observations for radio noise from meteors have been made on 1 c/s, and 30, 218 and 475 Mc/s. The flux sensitivity limits were (in Wm^2 sec^{-1}) 2×10^{-20}, 2×10^{-19}, 1×10^{-21} and 1×10^{-22} respectively. No emission from meteors was detected on any of the wavelengths. The efficiency of a meteor in converting kinetic energy into radio emission is therefore very low, less than 10^{-16} per unit bandwidth.

M.W.Ovenden

523.5

6590. DISTRIBUTIONS OF HELIUM-3 IN THE CARBO METEORITE. E.L.Fireman.
Nature (London), Vol. 181, 1725 (June 21, 1958).

The distribution of He^3 throughout a section of this meteorite was measured by neutron activation. These results are discussed in relation to the original shape of the meteorite and to the energy of cosmic-ray protons responsible for this He^3.

M.A.Grace

523.57

6591. THE ORBIT AND SPECTRUM OF A BRIGHT SPORADIC METEOR. I.Halliday.
J. Roy. Astron. Soc. Canada, Vol. 51, No. 5, 287-97 (Oct., 1957).

Two direct photographs with Super-Schmidt meteor cameras and two spectrograms secured with transmission diffraction grating were obtained at Meanook and Newbrook, Alberta, for a bright meteor on 20 October 1955. The trail was photographed between heights of 116 and 82 km above sea level. The corrected geocentric and heliocentric velocities were, respectively, 57.42 and 42.31 km/s with the corrected geocentric radiant at $\alpha = 4^h\ 38^m\ 13^s$, $\delta = +35^\circ 37'$ (1950.0). Within the errors of observation the velocity is parabolic and an orbit was computed on this assumption, which shows a high inclination to the ecliptic and a small perihelion distance. The orbit is similar to long-period comet orbits. The spectrum is typical of meteors with large geocentric velocities. A total of 29 features were identified in the Newbrook spectrogram. A combination of the four photographs shows that the terminal burst of light must have contained at least three distinct maxima.

A

523.7

6592. THE SUN'S GENERAL MAGNETIC FIELD. H.Alfvén.
Tellus, Vol. 8, No. 1, 1-12 (Feb., 1956).

The solar magnetic field, (including the interplanetary field) is discussed. It is pointed out that in the absence of a theory of the Zeeman-effect in a turbulent atmosphere it is at present impossible to derive a value of the sun's general magnetic field from spectroscopic measurements. From the magnetohydrodynamic theory of sunspots a value of the sun's general magnetic field can be derived. Ananthakrisnan's diagrams of the prominence activity can be interpreted as due to the same disturbance wave as is causing the sunspots. This gives further confirmation to the theory, which indicate

agnetic field of $H_p = 12$ G. The magnetic field outside the sun nterplanetary field) is certainly far from a dipole field. An approxiate model of the field is tentatively suggested. This model is in greement with information derived from cosmic-ray and magnetic-torm data and is also reconcilable with the coronal ray structure.
A.
523.7

593. THE SUN'S GENERAL MAGNETIC FIELD. H.W.Babcock.
ature (London), Vol. 178, 533 (Sept. 8, 1956).
A refutation of statements made by Alfvén (see preceding abtract) asserting the impossibility of deriving a value of the sun's eneral magnetic field by spectroscopic means. D.R.Barber
523.745

594. FLOCCULI AND THE TWENTY-SEVEN-DAY RECURENCE IN MAGNETIC DISTURBANCES.
.R.Mustel' and O.N.Mitropol'skaya.
stron. Zh., Vol. 35, No. 2, 194-207 (1958). In Russian.
The correlation between the 27-day sequences of geomagnetic isturbances during 1929-1933 and flocculi is studied. It is concluded that (a) the disturbances can all be connected with the passge of flocculi across the visible centre of the solar disk, (b) in rder to explain all the geomagnetic disturbances during 1929-1933 is necessary to assume that in some cases the disturbances may lso be observed when flocculi pass either below or above the centre f the disk and that occasionally the ejection of corpuscular streams ay not be accompanied by floccular emission, (c) the existence of delay of the disturbances with respect to the instant when the coresponding flocculi pass the central meridian is fully confirmed his delay may reach up to ten days, corresponding to speeds of 00 km/sec), (d) sunspots do not seem to have a large effect on the onditions of ejection of particles from flocculi but this must be onfirmed during a maximum of solar activity. S.Chomet
523.745 : 551.594.51

595. CHARACTERISTICS OF THE PROPERTIES OF ORPUSCULAR SOLAR EMISSION FROM THE SPECTRA OF URORAE. V.I.Krasovskiĭ.
stron. Zh., Vol. 35, No. 2, 222-6 (1958). In Russian.
The spectra of aurorae show that low-latitude aurorae are exited by particles with shorter paths,as compared with high-latitude urorae. It suggested that in some cases the emission may be explained by the following mechanism

$$N(^4S) + He^+(^2S) \rightarrow N^+(^3D) + He(^1S)$$

his applies particularly to the spectrum of the aurorae observed ear Moscow on January 21, 1957. S.Chomet
523.75 : 550.385

596. SOLAR ACTIVITY AND GEOMAGNETIC DISTURBANCES N 1942-1944. É.R.Mustel' and A.S.Dvoryashin.
stron Zh., Vol. 35, No. 1, 3-17 (1958). In Russian.
A correlation between geomagnetic and solar phenomena is stablished using the data for 1942-44. It is shown that the passage f a flocculus across the visible centre of the solar disk is followed, fter some delay, by a geomagnetic disturbance. This time delay ay be as long as ten days, but usually lies between four and six ays, which, according to Chapman's calculations (Abstr. 2400-1/ 929), corresponds to velocities of 300-470 km/sec. In addition, here is some evidence that in certain cases the ejection of particles ay proceed independently of the presence of strong floccular emision in an active region, and the mechanism of ejection of particles ay, at least initially, be of an electromagnetic nature. However, in pite of these complications the general conclusion is that in the ajority of cases a region of corpuscular emission is accompanied y a flocculus. S.Chomet
523.752

597. RESEARCHES ON THE [CHROMOSPHERIC] SPICULES N PROJECTION ON THE SOLAR DISK. C.J.Macris.
nn. Astrophys., Vol. 20, No. 5, 179-84 (1957). In French.
An examination of spectroheliograph plates taken in H-alpha ith the Arcetric solar tower has revealed the existence of dark narkings, approximately circular, with a mean diameter of about " and a mean duration of about 6 min. There is a linear relation etween diameter and duration. The number of such features on he entire disk is $\sim 5 \times 10^4$. The properties of these features are ompared with those of chromospheric spicules observed at the olar limb. M.W.Ovenden
523.752

598. ON THE MODELS OF THE SOLAR CHROMOSPHERE.
.S.Shklovskiĭ and É.V.Konovich.
stron. Zh., Vol. 35, No. 1, 37-51 (1958). In Russian.
Current models of the solar chromosphere are reviewed and the model of Athay and Menzel (Abstr. 3445/1956) is discussed in some detail. It is argued, on the basis of radio observations, that the temperature of the interspicule regions of the upper chromosphere which, in the latter model, was taken as 100 000° is not consistent with an electron concentration greater than 4×19^0 cm^{-3}. Piddington's model (Astrophys. J., Vol. 116, 314-23, 1952) is shown to be in general agreement with radio observations obtained during the 1952 eclipse. Optical, as opposed to radio, observations are discussed and it is pointed out that only by combining these two kinds of observations is it possible to obtain correct values for the electron temperature and density in the chromosphere. It is shown that the ultraviolet emission of the chromosphere plays a major role in the excitation of helium. It is concluded that the electron temperature of the "hot" component of the chromosphere should be of the order of 12 000° while that of the "cold" component should be less than 6000°. Higher temperatures would not be consistent with radio observations. S.Chomet
523.755

6599. NEW DATA ON THE SOLAR SUPERCORONA.
V.V.Vitkevich.
Astron. Zh., Vol. 35, No. 1, 52-63 (1958). In Russian.
An interferometer is described which may be used to study the solar supercorona by investigating the transmission of radiowaves (e.g. from the radio star in Taurus) through it. Some very reliable data were obtained during 1953-1957 using this interferometer. These data show that electron irregularities of a certain type are always present within the range $4.5\ R_\odot < r < 12\ R_\odot$ They are better defined in the equatorial rather than the polar regions. It was found that the radiowaves are refracted through an angle of 0.5°-1°. The electron density which would give rise to such a refraction is estimated. It is concluded that the radio data tend to support the hypothesis of the presence of coronal rays at large distances (of the order of 10 $R_\odot$). S.Chomet
523.77

6600. ON TECHNETIUM LINES IN THE SOLAR SPECTRUM. I.
A.A.Nikitin.
Astron. Zh., Vol. 35, No. 1, 18-25 (1958). In Russian.
The most intense technetium lines are compared with the corresponding unidentified lines in the solar spectrum. The following unidentified lines in the solar spectrum appear to be the most interesting from the point of view of further comparison with technetium lines: 5620.45, 5589.10, 4238.24, and 3636.05 A. It is pointed out that the 3195.23 line which is usually ascribed to Tc II, and which is at the basis of all the Tc identifications blends with the lines Mo at 3195.235 A and Fe at 3195.231 A. Further studies are therefore necessary. S.Chomet
523.774

6601. OBSERVATIONS OF SUNSPOTS NEAR THE [SOLAR] LIMB AT Hα. W.Mattig.
Naturwissenschaften, Vol. 45, No. 5, 104-5 (1958). In German.
Spectra of sunspots near the solar limb when examined within the core of the Hα line show marked but variable shifts in relation to the photospheric profile (the so-called "limb displacement" effect). An explanation is sought in terms of the contributions of sunspot radiation originating at different levels above the photosphere.
D.R.Barber
523.852.3 : 523.164.4

6602. THE EVOLUTION OF THE EXTRA-GALACTIC NEBULAE AND THE ORIGIN OF META-GALACTIC RADIO NOISE.
C.E.R.Bruce.
Phil. Mag. (Eighth Ser.), Vol. 3, 539-40 (May, 1958).
Reference is made to previous publications of the author discussing the generation of electric fields to breakdown strength in gaseous atmospheres by the charging of dust-particles by asymmetrical impacts, and the significance of this process in the study of long-period variable stars and extra-galactic nebulae. The theory leads to an understanding of the "jet" in NGC 4486, and the emission of radio noise. M.W.Ovenden
523.872

6603. NEBULAR SPECTRA OBTAINED BY ELECTRON PHOTOGRAPHY. A.Lallemand, M.Duchesne, C.Fehrenbach, G.Wlérick, M.Chopinet and R.Augarde.
C.R. Acad. Sci. (Paris), Vol. 246, No. 16, 2342-4 (April 21, 1958). In French.
For the first time spectrograms of galactic and extra-galactic nebulae have been successfully photographed with an electron camera attached to the 120 cm reflector of the Observatory of Haute-

Provence. The new technique ensures adequate resolution with exposure times (2-15 min) much shorter than those required for traditional methods. D.R.Barber

523.877

6604. A CALCULATION OF THE PROFILE OF THE H_δ LINE FOR MODELS OF A STELLAR ATMOSPHERE IN RADIATIVE EQUILIBRIUM AND IN ADIABATIC EQUILIBRIUM IN THE CONVECTIVE ZONE. M.Fracassini and M.Hack.
Mem. Soc. Astron. Ital., Vol. 28, No. 4, 347-59 (1957). In Italian.

The profile is calculated under the assumptions that diffusion is negligible and that the width of the line is due entirely to the interatomic Stark effect. Comparison of the calculated curves with observations shows that only exceptionally luminous supergiant stars agree with the adiabatic model. L.Pincherle

525.3

6605. ON THE EFFECT OF TIDAL FRICTION ON THE MOTION OF AN EARTH SATELLITE. G.A.Leĭkin.
Astron. Zh., Vol. 35, No. 2, 297-300 (1958). In Russian.

The lifetime of a satellite, depending on tidal friction, is estimated. It is assumed that the orbit is circular and equatorial, and that the earth is spherical, perfectly rigid and covered by an ocean of constant depth. The change in the earth–satellite distance is assumed to occur as a result of an interaction with a tidal wave produced by the satellite. It is concluded that if the mass of the satellite is 10^{25} g then its lifetime will be as follows:

height above earth's surface (km):	483	965
time of descent (days):	59	136.

S.Chomet

525.3

6606. RECORDING OF TIME DURING THE PHOTOGRAPHY OF ARTIFICIAL EARTH SATELLITES. Yu.M.Lipskiĭ.
Astron. Zh., Vol. 35, No. 2, 301-4 (1958). In Russian.

A photoelectric device attached to a special camera used to photograph artificial satellites is described. The device records the mid-points of exposures made with the camera. The instants can be determined to within 0.001-0.003 sec. S.Chomet

525.3

6607. DETERMINATION OF ORBITAL CHARACTERISTICS OF AN EARTH-SATELLITE FROM SINGLE-STATION RADIO-TRANSIT OBSERVATIONS.
G.Grant, A.L.Jones, R.W.Burhans, P.S.Fay and D.Frazier.
Nature (London), Vol. 181, 900-1 (March 29, 1958).

Meridian transit radio observations of Satellite 1958 α were made with a Minitrack Mark II interferometer, modified to suit the low altitude of the satellite at the observing station (41°26'3 N, 81°32' W). Fifty-six transits between 15 and 27 February were selected for analysis. The variation of the time between successive transits can give information of the inclination, and the rates of change of the period, the right ascension of the ascending node and the argument of perigee. The rates of change were found by comparing the observed intervals between transits with values computed on an IBM 650 machine, using initial elements from HAC 1393. The rates of change so found are tabulated, with errors. The rate of change of the period implies a life-time of the order of two years. M.W.Ovender

526.

6608. THE GRADIENT OF THE GRAVITATIONAL FIELD. A.Norinelli.
R.C. Accad. Naz. Lincei, Vol. 22, No. 4, 470-7 (April, 1957). In Italian.

The gradient considered is $\overline{\nabla}F$, where F is the magnitude of the perturbation in the terrestrial field intensity due to a local geological formation. The deductions that can be made from a knowledge of points at which $\overline{F}$ and $\overline{\nabla}F$ are parallel are discussed in the case of a field due to two point masses. R.A.Newing

526.7

6609. RESULT OF A NEW ABSOLUTE DETERMINATION OF THE ACCELERATION DUE TO GRAVITY AT THE PAVILLON DE BRETEUIL. Å.Thulin.
C.R. Acad. Sci. (Paris), Vol. 246, No. 24, 3322-4 (June 16, 1958). In French.

The determination is by photography of a freely falling graduate scale illuminated by accurately-timed flashes of light lasting for 0.2 μsec. The mean value of g from 20 experiments is 980 927.7 mg at "Sèvres Point A". This is 13.1 mgal less than the value in the Potsdam system. The uncertainty of the result is claimed to be less than 1 mgal. A.H.Cook

529.78 : 535.8

6610. A PROJECTION CLOCK WITH A DISTINCT SYSTEM OF TIME INDICATION. U.Adelsberger, G.Ohl and R.Süss.
Z. angew. Phys., Vol. 8, No. 12, 592-5 (Dec., 1956). In German.

A clock is described to give greater clarity of reading than the conventional hands moving over a clock-face. A central rotating circle indicates seconds, while the minutes are shown as numerals in a window, whose position around the second circle corresponds to the hour. An optical projection system is shown to enable photographic records to be made. Some details of the mechanism and sample recordings are given. R.W.Fish

PHYSICS

FUNDAMENTALS

530.1 : 531.612

6611. THE LAW OF CONSERVATION OF MOMENTUM AND THE MEASURE OF MOMENTUM IN PHYSICS. V.S.Sorokin.
Uspekhi fiz. Nauk, Vol. 59, No. 2, 325-62 (1956). In Russian.

The author sets out the facts which must serve as the starting point of any philosophical discussion concerning mass, energy and the law of conservation of momentum. In order to show more clearly the roots of the law of equivalence of mass and energy the theory is developed first on the basis of the classical assumptions concerning space and time, then all the discussion is repeated taking critical velocity into account. C.R.S.Manders

530.11

6612. PHYSICS AND METAPHYSICS. L.de Broglie; L.Rosenfeld.
Nature (London), Vol. 181, 1814, 1814 (June 28, 1958).

De Broglie defends the viewpoint that the probabilistic interpretation of quantum theory does not represent a complete description of physical reality and must ultimately be replaced by an interpretation which gives a "more clear and more intelligible image of microphysical facts", and therefore the attempts of Bohm and others to introduce new "levels" of physical reality are perfectly justified. Rosenfeld replies that the effects of the uncertainty principle, arising from the complementarity relations, make such attempts meaningless. P.K.Kabir

530.12 : 538.

6613. SINGULAR ELECTROMAGNETIC INDUCTION. Pham Mau Quan.
C.R. Acad. Sci. (Paris), Vol. 246, No. 19, 2734-7 (May 12, 1958). In French.

It is shown that the energy momentum tensor associated with a singular electromagnetic induction in a region of space–time can be interpreted as a tensor associated with a pure matter field. R.A.Newing

530.12 : 530.1

6614. DEFINITION OF AN ENERGY DENSITY AND A GENERALIZED STATE OF TOTAL RADIATION. L.Bel.
C.R. Acad. Sci. (Paris), Vol. 246, No. 21, 3015-18 (May 28, 1958). In French.

For a given time-like vector, a scalar energy density is introduced which reduces to Synge's invariant density in the case of a Schwarzschild field. The state of total radiation is a generalization of that introduced by Lichnerowicz. R.A.Newing

530.12 : 532.

6615. HELMHOLTZ EQUATIONS. DETERMINATION OF VELOCITIES FROM VORTICITY. THE PROBLEM OF EVOLUTION. Y.Fourès-Bruhat.
C.R. Acad. Sci. (Paris), Vol. 246, No. 24, 3319-22 (June 16, 1958). In French.

Relativistic analogues of the Helmholtz equations for vorticity are established for a perfect fluid, and it is proved that the motion

uniquely determined for suitable initial conditions.

R.A.Newing

530.12

16. FUNDAMENTAL EQUATIONS OF THE RELATIVISTIC ECHANICS OF A MATERIAL POINT WITH VARIABLE MASS. S.Kalitzin.

ovo Cimento, Vol. 8, No. 6, 843-9 (June 16, 1958). In German.

Previous formulae are generalized by allowing for relativistic ass defect. The results are applied to the theory of rocket pro-sion in the absence of external forces; for rocket speeds v small comparison with exhaust speeds q,

$$v/q = (1 - q^2/c^2)^{-1/2} \log(m_0/m).$$

R.A.Newing

530.12

17. STABILITY OF A SCHWARZSCHILD SINGULARITY. Regge and J.A.Wheeler.

ys. Rev., Vol. 108, No. 4, 1063-9 (Nov. 15, 1957).

It is shown that a Schwarzschild singularity, spherically mmetrical and endowed with mass, will undergo small vibrations out the spherical form and will therefore remain stable if sub-cted to a small nonspherical perturbation. A.

530.12

18. CONSERVATION LAWS IN GENERAL RELATIVITY. N.Goldberg.

ys. Rev., Vol. 111, No. 1, 315-20 (July 1, 1958).

The conservation laws are examined from the transformation operties of the Lagrangian. The energy–momentum complex tained has mixed indices, $T_\mu{}^\nu$, whereas a symmetric quantity $^{\mu\nu}$ is required for the definition of angular momentum. Such a mmetric quantity has been constructed by Landau and Lifshitz. the course of examining the relationship between these quantities, o hierarchies of complexes $T_{(n)}{}_\mu{}^\nu$ and $T_{(n)}{}^{\mu\nu}$ are constructed. der linear coordinate transformations the former are tensor nsities of weight (n + 2). For n = 0 these reduce to the canonical $^\nu$ and the Landau–Lifshitz $\mathfrak{T}^{\mu\nu}$, respectively. By requiring the ergy–momentum complex to generate the coordinate transforma-ns, and the total energy and momentum to form a free vector, one n identify the canonical complex $T_\mu{}^\nu$ as the appropriate quantity describe the energy and momentum of the field plus matter. nilarly, by requiring the total angular momentum to behave as a e antisymmetric tensor, one can construct, in the usual manner, appropriate quantity from $\mathfrak{T}_{(-1)}{}^{\mu\nu}$. The angular momentum com-x so defined differs from that proposed by Landau and Lifshitz as ll as from an independent construction by Bergmann and Thomson. A.

530.12

19. ON THE MOTION OF ROTATING MASSES IN THE NERAL THEORY OF RELATIVITY. P.Ryabushko and I.Z.Fisher.

. éksper. teor. Fiz., Vol. 34, No. 5, 1189-94 (1958). In Russian.

The relativistic equations deduced earlier (Abstr. 5600/1958) translational and rotational motion of spherically symmetric ating bodies are integrated. Some novel relativistic effects due the proper rotation of the bodies are detected and discussed. A.

530.12 : 538.3

ON THE GEOMETRIZATION OF THE ELECTROMAGNETIC ELD. See Abstr. 6063

530.145 : 539.165

β-DECAY AND NON-CONSERVATION OF PARITY. See str. 6255

530.145 : 539.165.2

BETA DECAY OF ORIENTED NUCLEI IN CONNECTION WITH RITY NON-CONSERVATION. See Abstr. 6260

530.145 : 539.165.2

PARITY NON-CONSERVATION AND β-DECAY. See Abstr. 6266

530.145

20. GENERAL COVARIANT FIELD EQUATIONS WITH RBITRARY SPINS. Duan' I-shi.

. éksper. teor. Fiz., Vol. 34, No. 3, 632-6 (1958). In Russian.

The Gel'fand–Yaglom wave field equations (Abstr. 3590/1948) e extended to the general theory of relativity. A.

530.145 : 538.3

6621. MINKOWSKI ELECTRODYNAMICS AS A RESULT OF A FIELD-THEORETICAL STUDY. E.Schmutzer.

Ann. Phys. (Leipzig), Vol. 20, No. 7-8, 349-54 (1957). In German.

Arguments based on the splitting of the Lagrange density into a field part and a medium part are used to decide in favour of the Minkowski tensor rather than the Abraham tensor. W.A.Hepner

530.145

6622. SOME ASPECTS OF THE COVARIANT FUNCTIONAL FORMALISM OF FIELD THEORY. II. R.S.Liotta.

Nuovo Cimento, Vol. 8, No. 6, 798-806 (June 16, 1958).

Hamilton's covariant equations for an electromagnetic field in the presence of a given current are written based on the previous part (Abstr. 4186/1956). The Jacobi equation is written such that it defines a class of canonical transformations which conserve the true covariance of the scheme. By means of a proper introduction of covariant functional operators, the Tomonaga equation is written such that it is covariant independently of the particular choice of canonical variables, and, hence, is covariant even in the Schrödinger representation. It is shown by means of a generalization of the W.K.B. method that under certain assumptions the Tomonaga equation reduces to the classical Jacobi equation. A.

530.145

6623. RENORMALIZATION OF AXIAL VECTOR COUPLING. II. J.C.Polkinghorne.

Nuovo Cimento, Vol. 8, No. 5, 781 (June 1, 1958).

This discusses the assumptions made in an earlier letter by the same author (Abstr. 3701/1958). J.C.Taylor

530.145

6624. CHIRALITY OF TENSORS AND PARITY-NONCONSERVING INTERACTIONS. Y.Tanikawa and S.Watanabe.

Phys. Rev., Vol. 110, No. 1, 289-90 (April 1, 1958).

Defining a chirality operator X by $X \cdot X = I$, $X \cdot I = I \cdot X = X$, $X \cdot P = -P \cdot X$ where P is the parity operator, the simplest representation of the group consisting of I, P and X is of second rank. Using such a representation, it is obvious that there exist two distinct chiralty operators, X and Y say, such that I, P, X and Y are linearly independent and Y satisfies the same equations as X. Requiring, for symmetry, $X \cdot Y = -Y \cdot X$ [in a 2×2 representation it is not possible to have $X \cdot Y = Y \cdot X$] it follows that $X \cdot Y \cdot P$ commutes with X, Y and P, i.e. it is a multiple of I. Therefore, all tensors will be invariant (except for an arbitrary phase factor) under the combined transformation $X \cdot Y \cdot P$. It is postulated that all interaction Lagrangians should also be invariant under one and only one of these transformations separately. Then the strong interactions must be taken to be invariant under P, whereas the parity non-conserving Fermi interactions will consist of $S \pm P$ variants or $V \pm A$ variants, corresponding to invariance under Y and X respectively.

P.K.Kabir

530.145 : 539.14

6625. FUNDAMENTAL INTERACTIONS AND HYPERFRAGMENTS. H.Weitzner.

Phys. Rev., Vol. 110, No. 2, 593-4 (April 15, 1958).

The simplest effective pion–lambda interaction satisfying all the necessary invariance properties must be of the form $\varphi_\pi \varphi_\pi \bar{\psi}_\Lambda \psi_\Lambda$. Since two pions appear at each effective vertex, these may be exchanged with two different nucleons or with the same nucleon in a hyperfragment. Thus a three-body term should appear in any potential based on pion exchange, with simple symmetry properties; this seems to have been neglected in other studies of hyperfragments. The potential between two nucleons and a lambda calculated from the phenomenological interaction above, in the static limit of the lowest non-vanishing order of perturbation theory, differs from the corresponding potential obtained from the nonrelativistic approximation to the specific interactions given by Schwinger (see Abstr. 2767/1958) only in that it contains no dependence on the lambda spin. This dependence is quite important since without such dependence, the binding energy of a lambda in a large nucleus should be quite large, 30 MeV or more; however, it cannot be determined reasonably from the treatment described above, although indications are that the potential between a lambda and a nucleon is stronger in singlet states. Variational calculations with the potential obtained, omitting the lambda-spin dependence, show that the binding energies of $_\Lambda H^3$, $_\Lambda He^4$, and $_\Lambda H^4$, and the non-existence of $_\Lambda H^4$ could be reproduced with a potential in which the parameter representing the strength of the three-body interaction is 0.35 times that representing the direct nucleon–lambda potential, 107 MeV.

P.K.Kabir

530.145

6626. NOTE ON RELATIONS BETWEEN BARYON–MESON COUPLING CONSTANTS. A.Pais.
Phys. Rev., Vol. 110, No. 6, 1480-1 (June 15, 1958).

In a previous paper (Abstr. 3704/1958), it was shown that the existence of certain baryon–meson coupling constant relations, which state in essence that Σ^- and Λ-particles are coupled with the same strength, whether to π^- or to K-mesons, lead to directly verifiable connections between observables. It is now shown that these relations exhaust the possibility of establishing stronger connections than those implied by charge-independence.

P.K.Kabir

530.145

6627. CONSERVED CURRENTS IN THE THEORY OF FERMI INTERACTIONS. M.L.Goldberger and S.B.Treiman.
Phys.Rev., Vol. 110, No. 6, 1478-9 (June 15, 1958).

Feynman and Gell-Mann (Abstr. 507/1958) have suggested a conserved pseudovector current in the theory of β-decay and μ-decay, and a conserved strangeness-violating current in the theory of strange-particle decay. It is shown that the former suggestion gives a large pseudoscalar component in β-decay, contrary to experiment; the latter suggestion gives a $K_{e3}/K_{\mu 3}$ branching ratio in conflict with present (less certain) evidence. R.J.N.Phillips

530.145

6628. POSSIBILITY OF FORMULATION OF A THEORY OF STRONGLY INTERACTING FERMIONS.
A.A.Abrikosov, A.D.Galanin, L.P.Gorkov, L.D.Landau, I.Ya.Pomeranchuk and K.A.Ter-Martirosyan.
Phys. Rev., Vol. 111, No. 1, 321-8 (July 1, 1958).

A fermion field is investigated with the interaction Lagrangian density equal to $g(\bar{\psi}O_j\psi).(\bar{\psi}O_j\psi)$. This point interaction is considered as a limit of an extended one, where it is supposed that the interaction vanishes if the momentum of a particle exceeds Λ and/or if the momentum transferred in a collision of two particles exceeds λ. The relation between Λ and λ is such as to make the quantity $\lambda^2/\ln(\Lambda/\lambda)$ arbitrarily small as $\lambda \to \infty$ and $\Lambda \to \infty$. This choice of the limiting procedure considerably simplifies the investigation of the theory. It is shown that in the limit $\lambda \to \infty$, $\Lambda \to \infty$, the physical interaction between particles vanishes in all types of four-fermion interaction. The case of two interacting fields ψ and χ with different isotopic spin is also considered. Going over to the local theory, the physical interaction vanishes in this case as well. This result shows that in the cases considered no strongly interacting fermion theory can be constructed. In the case of weak interaction, although no logically consistent theory can be built up, there does exist the perturbation theory, as in electrodynamics, which is valid for sufficiently small energies. A.

530.145

6629. QUASI-CLASSICAL QUANTIZATION IN A MAGNETIC FIELD.
A.M.Kosevych.
Ukrayin. fiz. Zh., Vol. 1, No. 3, 261-4 (1956). In Ukrainian, with summary ($\frac{1}{2}$ p.) in Russian.

Quasi-classical quantization of the motion of an electron with arbitrary dispersion law in a magnetic field may be arrived at by another, independent method, andfurther, this quantization is readily generalized for the motion when electric and uniform magnetic fields are mutually perpendicular. C.R.S.Manders

530.145

6630. STRONG AND WEAK INTERACTIONS INVOLVING HYPERONS. Khu Nin.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 646-50 (1958). In Russian.

Gell-Mann's universal strong interaction theory is extended to weak interactions. In the present scheme, however, the equality of intrinsic masses of Σ, Ξ and N is not assumed. The theory leads to the well-known selection rule $\Delta T = \pm\frac{1}{2}$. A.

530.145

6631. ON THE QUESTION OF TIME REVERSAL IN STRONG INTERACTIONS. P.Stichel.
Z. Phys., Vol. 150, No. 3, 264-71 (1958). In German.

The polarization correlation for the γ-radiation and the γ–γ angular correlation are calculated for polarized γ-emitting nuclei and it is shown that measurment of these quantities could be used to test invariance under time reversal in strong interactions. P.Roman

530.145 : 530.12

6632. THE SPINOR SPACE. J.Rzewuski.
Bull. Acad. Polon. Sci. Sér. Sci. math. astron. phys., Vol. 6, No. 4, 261-9 (1958).

A spinor space must have eight dimensions to be able to represent all points of Minkowski vector space. Such a spinor space is supposed fundamental, and its properties examined. Among transformations which leave Minkowski space unchanged are some which correspond to rotations in a three-dimensional isobaric-spin space, offering a geometrical meaning for the latter. R.J.N.Phillips

530.145

6633. A NEW NON-LINEAR GENERALIZATION OF THE THEORY OF PARTICLES WITH SPIN. G.Petiau.
C.R. Acad. Sci. (Paris), Vol. 246, No. 18, 2581-3 (May 5, 1958). In French.

With the introduction of new non-linear wave equations having the form of first-order partial differential equations, one finds multiply periodic plane-wave solutions, Jacobian elliptic functions or Abelian functions. S.F.Edwards

530.145

6634. LIMITS ON COUPLING CONSTANTS IN FIELD THEORIES WITH FINITE SOURCES. M.A.Ruderman and S.Gasiorowicz.
Nuovo Cimento, Vol. 8, No. 6, 861-77 (June 16, 1958).

The interaction of a boson field with a source is assumed to vanish outside of a radius a; no special properties are assumed for this source within the radius. It is shown that with such a model for the interaction of pions of K-mesons with nucleons and hyperons, rigorous upper limits, depending only upon a and the particle masses can be established for the renormalized coupling constants $g^2_{\Lambda\Sigma\pi}$, $g^2_{p\Sigma K}$, and $g^2_{p\Lambda K}$ corresponding to the matrix elements for the processes $\pi + \Lambda^0 \leftrightarrow \Sigma$, $K + p \leftrightarrow \Sigma$ and $K^- + p \leftrightarrow \Lambda^0$. For the pion–nucleon interaction a maximum $g^2_{np\pi}$ is found, above which there must exist a doubly charged state of the system $\pi^+ + p$. If $g^2_{np\pi}$ does approach infinity or if a approaches zero, it is proved that the neutron–proton mass difference goes to zero independently of other interactions or whether the bare masses are identical. Similar results hold for the mass difference of any baryon pair if they transform into each other by single boson emission or absorption. Finally a general class of field theory models, which will always have "ghosts", is described. A.

530.145 : 539.12

6635. PARTICLES AND SYMMETRIES. E.Corinaldesi.
Nuclear Physics, Vol. 7, No. 4, 305-72 (July [1], 1958).

This is a systematic review of the use of (chiefly) discrete symmetry transformations in a field theoretic setting. The selection rules for positronium decay are typical of the results deduced. There are chapters on parity, charge conjugation, charge symmetry, time reversal (a useful, simple account), weak interactions, and new particles. The last two subjects are surveyed briefly. J.C.Taylor

530.145

6636. SOME REMARKS ON THE COMPOUND MODEL OF ELEMENTARY PARTICLES. L.B.Okun'.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 469-76 (1958). In Russian.

Some properties are considered of the compound model of elementary particles in which Λ-hyperons and nucleons are assumed to be the primary particles. A.

530.145

6637. CHARGE DISTRIBUTION OF A BOUND STATE IN THE BETHE–SALPETER FORMALISM. G.Wanders and H.Ruegg.
Arch. Sci. (Geneva), Vol. 10, No. 2, 247-54 (April-June, 1957). In French.

This is studied for a bound S-state of two scalar particles, one charged and one neutral. A correspondence with the Schrödinger formalism is established for a particular case in the non-relativistic limit. R.J.N.Phillips

530.145 : 539.14

6638. ON THE DISTRIBUTION OF THE S-MATRIX POLES IN THE OPTICAL NUCLEAR MODEL CASE. J.M.Lozano.
An. Inst. Fís., Vol. 1, 49-54 (1955). In Spanish.

530.145

6639. VELOCITY DEPENDENCE OF THE TWO-NUCLEON INTERACTION. S.Okubo and R.E.Marshak.
Ann. Phys. (New York), Vol. 4, No. 2, 166-79 (June, 1958).

Invariance arguments are used to derive the most general

elocity dependent charge independent two-nucleon interaction in the onrelativistic approximation. If one stays on the energy shell, the nly essentially new term in the two-nucleon interaction is the quadatic spin–orbit potential. Off the energy shell, the quadratic spinomentum potential must be treated as independent. In meson heory, the quadratic terms arise as $(\mu/M)^2$ (μ is the pion mass, M he nucleon mass) corrections to the second-order static potential in ontrast to the linear spin–orbit potential which originates as a μ/M) correction to the fourth-order static potential. A.

530.145

640. A TABLE OF THE INCOHERENT SCATTERING FACTOR. .Tietz.
Nuovo Cimento, Vol. 8, No. 3, 441-4 (May 1, 1958). In German.

Using the Thomas–Fermi differential equation and the boundary onditions for the Thomas–Fermi function, the incoherent scatterng factor is expressed in a convenient form for computation. The actor is tabulated using the numerical values of Kobayashi for the homas–Fermi function. The results compare well with the numrical values given by Bewilogua (Abstr. 1262/1932).

M.J.Kearsley

530.145

641. ABOUT A CERTAIN METHOD FOR FINDING THE SYMPTOTIC PHASES. T.Tietz.
Nuovo Cimento, Vol. 8, No. 5, 765-6 (June 1, 1958).

The method is discussed for scattering in the presence of a Coulomb potential. G.H.Burkhardt

530.145

642. ON THE UNITARITY OF THE S-MATRIX IN QUANTUM FIELD THEORIES WITH INDEFINITE METRIC.
R.Ascoli and E.Minardi.
Nuovo Cimento, Vol. 8, No. 6, 951-3 (June 16, 1958).

The outlines of the proof of the following theorem are given: Consider a quantum theory with arbitrary metric, where the state vector satisfies a Schrödinger equation with a self-adjoint Hamiltonian. If now those eigenstates of H, which belong to real positive eigenvalues and are permitted by eventual supplementary conditions have never a negative norm, then a unitary S-matrix may always be definite and there is conservation of probability. As a consequence of this theorem it is shown that when considering the scattering of two θ-particles on one N-particle in the Lee model, the theory may be physically interpreted, provided a dipole ghost occurs. Moreover, the same conclusion may be drawn in the same scattering problem, even if there are two discrete non-orthogonal energy eigenstates of a V-particle which have a zero norm and belong to complex conjugate eigenvalues. Thus the occurrence of the the dipole ghost is not necessary for having conservation of scattering probability. On the other hand it may sometimes happen that, although the unitarity condition holds, it is impossible to give a proper probability interpretation. P.Roman

530.145

643. ANALYTICAL PROPERTIES OF THE SOLUTIONS OF THE CHEW–LOW EQUATIONS. M.Froissart and R.Omnès.
Nuclear Phys., Vol. 6, No. 5, 628-9 (May, 1958).

It is shown that the solutions of the Chew–Low equations can be continued analytically. In a few simple cases, this continuation leads to a finite Riemann surface with two sheets. In the general case, however, the number of sheets is infinite. A.

530.145

644. DOUBLE SCATTERING EXPERIMENTS AS A TEST FOR INVARIANCE UNDER TIME-REVERSAL IN STRONG INTERACTIONS. F.Mandl.
Proc. Phys. Soc., Vol. 71, Pt 4, 686-7 (April, 1958).

The polarization asymmetry equality in double scattering is independent of parity conservation but depends on invariance under time reversal, and thus affords a direct experimental test of this invariance. Numerical computations show that it would be quite a delicate test, in a typical case of strong interaction.

P.M.Davidson

530.145 : 539.12

645. THE KINETIC ENERGY OF A NUCLEON IN STRONG COUPLING THEORY. Yu.V.Tsekhmistrenko.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 3-11 (1957). In Ukrainian.

Considers the conditions of validity of non-relativistic representation of nucleon kinetic energy in the adiabatic theory of nucleon strong coupling with a pseudoscalar meson field.

C.R.S.Manders

530.145 : 539.12

6646. RADIATION CORRECTIONS TO PARTICLE SCATTERING IN EXTERNAL FIELD AND TO COMPTON EFFECT IN SCALAR QUANTUM ELECTRODYNAMICS. V.F.Aleksin and D.V.Volkov.
Zh. éksper. teor. Fiz., Vol. 33, No. 4 (10), 1044-5 (1957).
In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 6, No. 4, 803-4 (April, 1958).

Gives the second-order radiative corrections to the differential cross-section for scattering a scalar particle in an external electromagnetic field (Born approximation), including vacuum polarization effects from particles of spin 0 or 1/2. Also gives the differential cross-section for Compton scattering in scalar electrodynamics, with second-order corrections. R.J.N.Phillips

530.145

6647. APPLICATION OF QUANTUM FIELD THEORY METHODS TO THE MANY-BODY PROBLEM. V.M.Galitskiĭ and A.B.Migdal.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 139-50 (1958). In Russian.

It is shown that the energy and damping of quasiparticles are determined by the poles of a single-particle propagation function. The relation between the two-particle Green's function and the kinetic equation is established. A.

530.145

6648. ENERGY SPECTRUM OF A NON-IDEAL FERMI GAS. V.M.Galitskiĭ.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 151-62 (1958). In Russian.

The energy spectrum and energy of the ground state of a non-ideal Fermi gas with a repulsive interaction between the particles was found by expanding in powers of the ratio of the potential range to the mean distance between the particles (gas approximation). The first two terms of the expansion were obtained. A.

530.145 : 530.162

6649. APPLICATION OF COLLECTIVE VARIABLES AND INCLUSION OF SHORT-RANGE FORCES IN THE THEORY OF A SYSTEM OF CHARGED PARTICLES. I.R.Yukhnovskiĭ.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 379-89 (1958). In Russian.

The free energy and distribution function (binary and ternary) of charged-particle systems are computed including short-range forces. The corresponding expressions are written down in the form of a series in group integrals (correlations). It is shown that for electron plasma in a compensating field the Coulomb potential does not lead to divergencies in the expressions for the free energy or the distribution functions. The total free energy of a system of particles with a Coulomb interaction is also computed. The "transition function" for such systems is set up. A.

530.145

6650. APPLICATION OF QUANTUM FIELD THEORY METHODS TO A SYSTEM OF BOSE PARTICLES. S.T.Belyaev.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 417-32 (1958). In Russian.

The possibility of application of quantum field theory technique to a system of many Bose particles is demonstrated. Dyson's equation (Abstr. 4487/1949) for a single-particle Green's function is formulated. Some properties of the condensate in a system of interacting Bose particles are considered. A.

530.145

6651. ENERGY SPECTRUM OF A NON-IDEAL BOSE GAS. S.T.Belyaev.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 433-46 (1958). In Russian.

The single-particle Green's function is derived for a system of interacting Bose particles in the low-density approximation. The Green's function is used to determine the energy levels near the ground state (spectrum of quasiparticles). A.

530.145 : 539.14

NUCLEAR MAGNETIC MOMENT IN MESON FIELD THEORY. See Abstr. 6216

530.145 : 539.17

THE PHASES OF THE MATRIX ELEMENTS OF THE S-MATRIX. See Abstr. 6289

530.145

6652. APPROACH TO THE QUANTUM MECHANICAL MANY-BODY PROBLEM WITH STRONG TWO-PARTICLE INTERACTION. I. E.Andersén and U.Uhlhorn.
Ark. Fys., Vol. 13, Paper 14, 165-76 (1958).

An extension of the Hartree–Fock variational method is given, using n-particle trial wave-functions constructed from two-particle orbitals. Simplifying assumptions about the latter are introduced, and a one-dimensional example is considered. As a guide to the

best choice of orbital, the problem of two interacting particles in a common (oscillator) potential is examined. R.J.N.Phillips

530.145

6653. COULOMB WAVE FUNCTIONS.
A.Learner and B.A.Robson.
Austral. J. Phys., Vol. 11, No. 1, 138-42 (March, 1958).

Writing the regular Coulomb wave function as

$$F_L(\eta\rho) = A_L \rho^{L+1} f_L,$$

where A_L is given by a recurrence relation, a set of tables is given of the values of f_L and its derivative $f'_L(\partial F_L/\partial\rho)$ for $\eta \leq 10$, $\rho \geq 10$, $L = 5, 6, 10, 11$, $\Delta\rho = 1$ and $\Delta\eta = 1$. The accuracy of the tables is generally at least 0.01%. Recurrence formulae enabling intermediate and other L values to be found are provided. M.J.Kearsley

530.145

6654. CORRECTED BOHR–SOMMERFELD QUANTUM CONDITIONS FOR NONSEPARABLE SYSTEMS. J.B.Keller.
Ann. Phys. (New York), Vol. 4, No. 2, 180-8 (June, 1958).

For a separable or nonseparable system an approximate solution of the Schrödinger equation is constructed of the form $Ae^{i\hbar^{-1}S}$. From the single-valuedness of the solution, assuming that A is single-valued, a condition on S is obtained from which follows A, Einstein's generalized form of the Bohr–Sommerfeld–Wilson quantum conditions. This derivation, essentially due to L.Brillouin, yields only integer quantum numbers. The considerations are extended to multiple valued functions A and to approximate solutions of the form

$$\sum A_k \exp(i\hbar^{-1}S_k).$$

In this way the corrected form of the quantum conditions is deduced with the appropriate integer, half-integer or other quantum number (generally a quarter integer). The result yields a classical mechanical principle for determining the type of quantum number to be used in any particular instance. This fills a gap in the formulation of the "quantum theory", since the only other method for deciding upon the type of quantum numbers — that of Kramers — applies only to separable systems, whereas the present result also applies to nonseparable systems. In addition to yielding this result, the approximate solution of the Schrödinger equation — which can be constructed by classical mechanics — may itself prove to be useful. A.

530.145

6655. THE THEORY OF SYSTEMS OF PARTICLES IN THE CAUSAL INTERPRETATION OF WAVE MECHANICS.
J.Andrade e Silva.
C.R. Acad. Sci. (Paris), Vol. 246, No. 3, 391-3, (Jan. 20, 1958). In French.

A previous note (Abstr. 2801/1956) employing the theory of the double solution to obtain a representation, in physical space, of systems of two particles, is here extended to the case of a number of particles. The required equations are derived, and it is shown that no others would be satisfactory. P.M.Davidson

530.145 : 531.15

6656. ON THE QUANTUM THEORY OF SOLID BODIES IN ROTATION. G.Lochak.
C.R. Acad. Sci. (Paris), Vol. 246, No. 20, 2855-8 (May 19, 1958). In French.

It is shown that the matrix elements of the irreducible representations of the group of rotations form a complete system. The consequences of the theorem, in connection with the postulate of uniformity of the wave-functions and also its relation to the infrared spectra of polyatomic molecules, are discussed in detail.

M.J.Kearsley

530.145 : 530.12

6657. THE HYPOTHESIS OF CORPUSCULAR WAVES AND THE SPECIAL THEORY OF RELATIVITY. K.Stiegler.
Nuovo Cimento, Vol. 8, No. 6, 922-6 (June 16, 1958). In French.

The Lorentz transformations are derived from a set of axioms which include the linearity of space–time transformations and the association of de Broglie waves with point masses. The velocity of light appears as the square-root of the invariant ratio of energy to mass. R.A.Newing

530.145 : 530.12

6658. ON A MINIMUM PROPERTY OF FREE ENERGIES. T.D.Schultz.
Nuovo Cimento, Vol. 8, No. 6, 943-4 (June 16, 1958).

A new and more general proof is given for the theorem of Peierls (Abstr. 535/1939) which gives a lower bound to the partition sum of a quantum-mechanical system. P.Roman

530.145

6659. VARIATION THEOREM FOR EXCITED STATES.
H.Shull and P.O.Löwdin.
Phys. Rev., Vol. 110, No. 6, 1466 (June 15, 1958).

Analysis of the mean square deviation of the eigenvector of a secular equation from the exact eigenfunction, for a non-degenerate first excited state, following Eckart's (1930) treatment of the lowest state, shows that explicit orthogonalization to the lowest state is unnecessary, and that the use of different basis functions for different eigenstates is desirable. J.Hawgood

530.145

6660. SPECTRAL DECOMPOSITION OF THE OPERATOR $p^2 - q^2$.
N.G.van Kampen.
Physica, Vol. 24, No. 7, 545-56 (July, 1958).

It is shown that the operator $p^2 - q^2$ has a continuous spectrum extending from $-\infty$ to $+\infty$. The expansion of an arbitrary function with respect to the eigenfunctions is given. The action of the operators q and p on the eigenfunctions can be written explicitly by means of symbolic formulae. Finally, an alternative method for studying the behaviour of self-accelerating wave packets is given. A.

530.145

6661. ON THE GOODNESS OF APPROXIMATE SOLUTIONS.
H.Preuss.
Z. Naturforsch., Vol. 13a, No. 6, 439-42 (June, 1958). In German.

The approximate wave-functions, obtained by the usual variational methods, minimizing the energy, are generally poor approximations when used to evaluate other properties of the system (e.g. $\overline{r}$, $\overline{r^2}$), as different regions of the wave-function become important. A new variational procedure is described, which depends on the property to be studied and gives better results. The method is applied to the H atom and detailed comparison with the exact results are given. M.J.Kearsley

530.161

6662. IRREVERSIBLE PROCESSES AND FLUCTUATIONS.
N.Saitô.
J. Phys. Soc. Japan, Vol. 12, No. 12, 1321-6 (Dec., 1957).

The introduction of fluctuating forces into the phenomenological equations of irreversible processes allows one to treat the processes as Brownian motions. Using this method Fokker–Planck's equation describing the probability of occurrence of a set of events is obtained and Onsager's reciprocal relations and the principle of the least dissipation of energy are derived. An interpretation of irreversible production of entropy is proposed. Finally a critique of Popov and Karanikolov's theory is given. A.

530.162

6663. NUCLEAR SPIN ECHO EXPERIMENTS AND THE FOUNDATIONS OF STATISTICAL MECHANICS. J.Rothstein.
Amer. J. Phys., Vol. 25, No. 8, 510-18 (Nov., 1957).

The problem of reconciling the irreversibility of thermodynamics with the completely reversible mechanics of the ultimate constituents of the thermodynamical system is examined from an operational viewpoint. The informational nature of entropy is demonstrated, and the famous paradoxes of statistical mechanics, due to Loschmidt and Zermelo, are resolved with its aid. Spin-echo experiments are shown to realize the conditions of Loschmidt's reflection paradox, and used to illustrate how reversibility occurs only with perfect "memory" or information storage, while "forgetting" or loss of information implies irreversibility. A.

530.162 : 532.7

6664. ON THE DERIVATION OF HYDRODYNAMICAL EQUATIONS FOR THE CLASSICAL SYSTEMS OF DIATOMIC MOLECULES. R.Zelazny.
Bull. Acad. Polon. Sci. Sér. sci. math. astron. phys., Vol. 6, No. 3, 203-13 (1958).

This is based on the method of Bogolyubov. The Liouville equation is solved using a transformation to relative and centre of gravity coordinates and momenta for each molecule. The assumption of decay of correlation is included as the limiting equality of cluster distribution functions and products of the corresponding single-molecule ones, for long correlation times. Solutions are available only in the zeroth order. P.Gray

530.162 : 533.7

6665. A STUDY OF THE GENERALIZATION OF THE BOLTZMANN EQUATION TO QUANTAL CONDITIONS. J.Yvon.
C.R. Acad. Sci. (Paris), Vol. 246, No. 20, 2850-2 (May 19, 1958). In French.

Molecular chaos is assumed only for some initial instant, but particles do not interact in a classical sense, though they obey the exclusion principle. The result differs in a fundamental way from that of Uehling and Uhlenbeck (Abstr. 2496/1933), independently of the formulation. Here, the collision term is bi-linear in the density operator, while earlier it was tri-linear in the phase distribution function. P.Gray

530.162 : 537.312.62

6666. ON THE THEORY OF THE PHASE TRANSITION IN A NON-IDEAL BOSE-GAS. D.N.Zubarev and Yu.A.Tserkovnikov.
Dokl. Akad. Nauk. SSSR, Vol. 120, No. 5, 991-4 (1958). In Russian.

The Hamilton operator for an assembly of interacting bosons is formulated in terms of quantized amplitudes. The interaction terms, involving the product of 4 amplitudes, are simplified by admitting only those products which depend upon not more than 2 wave-functions (in plane wave representation upon not more than 2 wave-vectors). By this simplification the theory is linked to both Bogolyubov's theory of superconduction and his representation of the energy in terms of phonons. Applying relations from these two theories the thermodynamic functions of a boson gas are obtained. The existence of a second order transition is established. The specific heat remains finite; its derivative increases to infinity on approaching the transition point; the infinity is of the order of the $(-3/4)$ th power of the difference in temperature. R.Eisenschitz

530.162

6667. ON THE QUANTAL VIRIAL EQUATION FOR THE PRESSURE. W.B.Brown.
J. chem. Phys., Vol. 28, No. 3, 522-3 (March, 1958).

A short critical account of previous work is given. The theorem is rigorously proved using the reduced Schrödinger equation, by negating the justification for a quantal contribution to the pressure. See Abstr. 8506-7 (1950). P.Gray

530.162 : 523.877

6668. ON PARTITION FUNCTIONS. G.Noci and M.Rigutti.
Mem. Soc. Astron. Ital., Vol. 28, No. 4, 303-18 (1957). In Italian.

A study of the effects of errors in the constants k, α, β, and E on the quantity

$$u = \sum_{n,l,j} (2j + 1) \exp(-[\alpha p_e n^6 + \beta p_g n^3 + E_{n,l,j}]/kT)$$

Extensive numerical results are given for the case when u represents the "partition function" for sodium in "stellar" atmospheres. N.L.Johnson

530.162

6669. THE CLASSICAL LIMIT OF THE QUANTUM TRANSPORT EQUATION. R.Brout.
Physica, Vol. 23, No. 10, 953-4 (Oct., 1957).

The quantum mechanical "master equation" as established by van Hove is expanded in powers of Planck's constant. Neglecting all but the lowest powers the classical "master equation" appropriate to systems with weak interaction is obtained in accordance with the formulation by Brout and Prigogine. R.Eisenschitz

530.162 : 539.219

CONFIGURATIONAL PARTITION FUNCTIONS OF COOPERATIVE ASSEMBLIES. See Abstr. 6441

530.19 : 533.7

6670. ON THE INTERACTION BETWEEN A MOLECULAR GAS AND RADIATION. P.N.Roussopoulos.
C.R. Acad. Sci. (Paris), Vol. 246, No. 6, 899-901 (Feb. 10, 1958). In French.

Theoretical note giving the Hamiltonian of interaction between radiation and the current density due to the rotating molecules, and its transformation to eliminate longitudinal waves. J.Hawgood

530.19

6671. ON THE THEORY OF DIFFUSION OF RADIATION IN A SEMI-INFINITE MEDIUM. I.N.Minin.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 1, 63-5 (1958). In Russian.

An integral equation for the intensity $\Phi(\tau)$ of radiation at a certain depth τ in the medium is formulated in terms the Green's function $K(\tau - \tau')\,\Phi(\tau')$, τ' being any other depth. Possible forms of K are discussed, and Φ is tabulated as a function of depth. J.W.Gardner

530.19

6672. DIFFUSION OF RADIATION IN A PLANE LAMINA. V.V.Sobolev.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 1, 69-72 (1958). In Russian.

The intensity $B(\tau, \tau_0)$ at a given level τ, not on the boundary (τ_0), is expressed, through the usual integral propagation equation, in terms of the Green's function relating to $B(\tau', \tau_0)$ for all other levels τ', and an arbitrary source term. Possible source terms and boundary conditions are discussed. J.W.Gardner

530.19

6673. INVARIANT IMBEDDING, WAVE PROPAGATION, AND THE W.K.B. APPROXIMATION. R.Bellman and R.Kalaba.
Proc. Nat. Acad. Sci. U.S.A., Vol. 44, No. 4, 317-19 (April, 1958).

Wave propagation can be discussed in terms of reflection and refraction at infinitesimally separated interfaces. The convergence of the Bremmer series is established under a simple assumption about the slowly varying nature of the local wave-number. The W.K.B. method is generalized to certain vector matrix systems. Functional equation techniques determine the wave reflected by an infinite half-plane of inhomogeneous material. M.J.Kearsley

530.19

6674. FUNCTIONAL RELATIONS FOR THE R AND T OPERATORS ON PLANE-PARALLEL MEDIA. R.W.Preisendorfer.
Proc. Nat. Acad. Sci. U.S.A., Vol. 44, No. 4, 323-7 (April, 1958).

The case of finite, non-separable plane parallel media, in the theory of radiative transfer, is studied. Reflectance—transmittance pairs of functions for each of the two boundaries of the medium are involved. The four principles of invariance formulated are found sufficient to yield the integrodifferential equations governing the functions. M.J.Kearsley

530.19

6675. TIME-DEPENDENT PRINCIPLES OF INVARIANCE. R.W.Preisendorfer.
Proc. Nat. Acad. Sci. U.S.A., Vol. 44, No. 4, 328-32 (April, 1958).

Statements of the four time-dependent principles of invariance are formulated and shown to be sufficient to derive the functional relations governing the time-dependent R and T functions and their corresponding integral operators, in the theory of radiative transfer. The case of a finite, non-separable, plane-parallel medium, with attenuation and scattering functions dependent on time, is considered. M.J.Kearsley

530.19

6676. THE COHERENCE OF THE RADIATION OF A SYSTEM OF IDENTICAL PARTICLES. M.M.Al'perin.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 322-32 (1957). In Ukrainian.

A system of identical particles with two levels subject to perturbation varying with time is considered and the distribution function for a given number of excited particles is calculated using the exact solution of Schroedinger's equation. Maximum and minimum conditions of coherence are worked out. C.R.S.Manders

GENERAL MECHANICS. MECHANICS OF SOLIDS

531.25 : 535.55

6677. THE DEPENDENCE OF STRESS DISTRIBUTION ON ELASTIC CONSTANTS. M.Clutterbuck.
Brit. J. appl. Phys., Vol. 9, No. 8, 323-9 (Aug., 1958).

The effect of the elastic constants on certain stress distributions is investigated using the photoelastic technique. Similarity in stress distributions is obtained by suitable adjustment of the loads with respect to the Young's moduli of the materials from which the models are made, but no such adjustment is possible to compensate for the differences in their Poisson's ratios. The error introduced by this effect is considered by reference to problems of a particular type, from which some general conclusions are drawn. A.

531.25 : 535.55

6678. EXPERIMENTAL DETERMINATION BY AN OPTICAL METHOD OF THE STRESSES IN AN ANISOTROPIC PLATE SUBJECTED TO THE ACTION OF A CONCENTRATED FORCE. II. V.M.Krasnov, A.V.Stepanov and É.F.Shvedko.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 894-8 (1958). In Russian.

For Pt I see Abstr. 233 (1955). The state of stress in an

anisotropic plate made from a 60% TlBr + 40% TlI single crystal of the cubic system was investigated by an optical method. The case of a concentrated force directed along the (110) direction is considered. A.

531.311

6679. THE RELATIVISTIC LINEAR HARMONIC OSCILLATOR. R.Penfield and H.Zatzkis.
J. Franklin Inst., Vol. 262, No. 2, 121-5 (Aug., 1956).

The effects of mass variability on the motion of a mass in the field of an elastic force are investigated. Using a relativistic expression for the energy, it is shown that the displacement is an elliptic function of the time, and the period is a sum of two elliptic integrals of the first and second kinds. Comparing the results with the motion of a pendulum, the change in frequency due to mass variability is shown to be very much smaller than that due to the finiteness of the amplitude of vibration. M.J.Kearsley

531.44

6680. EXPERIMENTAL CHECKING OF THE TWO-TERM LAW OF FRICTION. G.I.Epifanov.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 6, 1113-15 (1958). In Russian.

The author refers to his previous paper (Dokl. Akad. Nauk SSSR, Vol. 114, No. 4, 764-7, 1957) in which it was shown that, when the magnitude of the area of shear during friction has been correctly estimated, the specific friction force is roughly equal to the shearing strength of that metal of the friction pair, in whose surface the shear takes place. The following relationship is developed

$$F = S_c\sigma_0 + kN,$$

where F is the force of friction, S_c the area of shear, σ_0 the shearing strength when the normal stress is 0, N the normal load, and k a coefficient. Two series of experiments show that F is mainly determined by the first term ($S_c\sigma_0$). F.Lachman

531.51

6681. THE POTENTIAL ENERGY OF A SMALL RIGID BODY IN THE GRAVITATIONAL FIELD OF AN OBLATE SPHEROID. R.E.Roberson and D.Tatistcheff.
J. Franklin Inst., Vol. 262, No. 3, 209-14 (Sept., 1956).

A formula is found for the mutual potential function of a small rigid body in the presence of a large gravitating body and expressed in terms of the principal moments of inertia of the small body. Particular examples considered are for a large oblate spheroid, a large sphere and also for a small body with circular symmetry about a certain axis. M.J.Kearsley

531.51 : 525.3

6682. GRAVITATIONAL TORQUE ON A SATELLITE VEHICLE. R.E.Roberson.
J. Franklin Inst., Vol. 265, No. 1, 13-22 (Jan., 1958).

Using a potential function for a small rigid body in the field of an oblate spheroid developed previously by Roberson and Tatistcheff (see preceding abstract), the gravitational torque on a satellite vehicle in the field of the earth is found. Results are the torque components along the satellite principal axes. The defining relationships are not completely reduced for large angular motions of the satellite, but torque components are found explicitly in terms of the angles of attitude deviation from a desired attitude reference for the small-angle case. A.

531.663

6683. THE EXPERIMENTAL EVALUATION OF THE FORCES DURING IMPACT OF A SPHERE ON A PLANE SURFACE. H.Mintrop.
Z. angew. Phys., Vol. 9, No. 9, 442-6 (Sept., 1957). In German.

A photographic method is described for determining the impact time and radius of contact when a steel sphere falls from different heights on to the plane end of a steel cylinder. Evaluation of the results in terms of impact forces shows disagreement with the Hertz theory, possibly because the elastic limit of the steel is exceeded. R.F.S.Hearmon

MECHANICAL MEASUREMENTS

531.717.1 : 535.417

MEASUREMENT OF THIN FILMS BY INTERFEROMETRY. See Abstr. 5812

531.752

6684. INFLUENCE OF KNIFE-EDGES AND PANS ON THE SENSITIVITY AND PERIOD OF BALANCES. H.Poltz.
Z. angew. Phys., Vol. 9, No. 3, 140-5 (March 1957). In German.

A theoretical and experimental investigation, for commercial scales (up to 250 kg) of the steelyard type, of the effect of the knife-edge support (pan) being non-plane. J.M.Hough

531.787.3

6685. INVESTIGATIONS TO DETERMINE THE DEFORMATION CORRECTIONS FOR A PISTON MANOMETER BY MEANS OF CAPACITY MEASUREMENT OF THE GAP WIDTH. H.J.Büttemann and M.Schuster.
Z. angew. Phys., Vol. 9, No. 1, 29-33 (Jan., 1957). In German.

By measuring the electrical capacity between piston and cylinder in a piston-type pressure-gauge for high pressures, the deformation of the system at different pressures may be measured and a correction factor deduced. T.Mulvey

531.787.9 : 534.232 : 621.317.39

6686. A PIEZO-ELECTRIC PRESSURE BAR GAUGE. D.H.Edwards.
J. sci. Instrum., Vol. 35, No. 9, 346-9 (Sept., 1958).

The average stress over the cross-section of the bar is measured by means of an X-cut quartz disk. Bars of duralumin and lead are employed since the acoustic impedances of these materials closely match the value appropriate to longitudinal thickness vibrations in the quartz. The design of a gauge housing, suitable for mounting in the wall of an explosion or shock tube, is discussed. A.

MECHANICS OF FLUIDS

532.13

6687. STOKES' AND EINSTEIN'S LAW FOR NONUNIFORM VISCOSITY. S.Broersma.
J. chem. Phys., Vol. 28, No. 6, 1158-68 (June, 1958).

The equations of hydrodynamics are solved for the case of a viscosity dependence upon the distance r to a particle of radius a, suspended in a continuous fluid, as given by $\eta_\infty/\eta(r) = 1 - \epsilon_m(a_m/r)^m$. When $|\epsilon| < 0.2$, $m \geq 0$ or $\epsilon \leq 1$, $m > 6$ the omissions are less than 25% of the new terms. The force upon a spherical particle is given by $6\pi v_\infty \eta_\infty a_m[1 + \epsilon_m/(m+1)\cdot(m^2 + 4m + 15)/(m+3)(m+5)]$. The torque upon a spherical particle is $8\pi\omega_\infty\eta_\infty a_m^3[1 + \epsilon_m\cdot 3/(m+3)]$. The viscosity of a dilute suspension with 1 particle per sphere of radius R is $\eta/\eta_\infty = 1 + \epsilon_m(a_m/R)^m\cdot 3/(3-m) + 5/2(a_m/R)^3 \times [1 + \epsilon_m 3/(m-3)\cdot(m^3 + 5m^2 + 47m - 21)/(m+3)(m+5)(m+7) + 4/5\epsilon_o]$. This enables a study of the diffusion constants of a suspended particle, its effect upon the viscosity of a fluid, and the transition of a liquid into a gel. Experimental data concerning proton magnetic relaxation times of diamagnetic solutions and self-diffusion of protein and solvent molecules are discussed. The effect of slipping is examined. A.

532.133 : 532.77

6688. VISCOSITY AND STRUCTURE OF LIQUID SOLUTIONS OF ZINC, CADMIUM, TIN, BISMUTH AND LEAD IN MERCURY. O.Z.Holȳk and N.A.Rȳndȳch.
Ukrayin. fiz. Zh., Vol. 1, No. 2, 170-82 (1956). In Ukrainian, with summary (1 p.) in Russian.

This is the eighth paper of a series on allied topics in various journals. Viscosities and their temperature variation were measured by the method described in Ukrains'kii Khemichnii Zhurnal, Vol. 27, 627 (1951). The curves for the solutions lay between the curves for the components. A pyknometer method was employed for density measurements. In a discussion of the data measured there is thought to be evidence of a connection between viscosity of the solution and the structure of the molecular field of the liquid. For Cd a concentration of up 20% by weight was possible, for Zn up to 8%, and for the other metals not more than some 5%. C.R.S.Manders

532.5 : 530.12

RELATIVISTIC ANALOGUES OF THE HELMHOLTZ EQUATIONS FOR VORTICITY. See Abstr. 6615

532.513 : 536.252

6689. AN EXPERIMENTAL STUDY OF THERMAL CONVECTION IN A ROTATING LIQUID. R.Hide.
Phil. Trans A, Vol. 250, No. 983, 441-78 (1958).

A detailed description is given of the investigation of thermally induced flow in water contained to a depth d (3 to 11 cm) in the space between two concentric cylinders of radii a and b (b > a) respectively.

The cylinders were mounted on a horizontal turntable with their axis vertical and the table could be rotated at angular speeds Ω, ranging from 0.86 to 8.23 rad/sec. They were maintained at different temperatures T_a and T_b by waterbaths. Clean aluminium powder was used as flow indicator and photographic observations were made of the top-surface flow pattern of the water by means of a rotoscope. The form of the pattern did not depend on whether T_b was $>$ or $<$ T_a, but the direction of hydrodynamical flow relative to the rotating system did depend on the sign of $(T_b - T_a)$, from which it may be concluded that of the two agencies, gravity and centripetal forces, responsible for buoyancy the latter is relatively unimportant. The flow depends on the dimensionless parameter

$$\Theta \equiv 2gd\,[\rho(T_a) - \rho(T_b)]/\Omega^2 (b - a)^2 [\rho(T_b) + \rho(T_a)],$$

where g is the acceleration of gravity and ρ (T) is the density of water at temperature T. When Θ exceeds a certain value Θ_{crit}, the flow is essentially a meridional circulation, in which the motion perpendicular to the axis of rotation is deflected by Coriolis forces. When Θ is somewhat $<\Theta_{crit}$, the flow is characterized by a regular quasi-horizontal wave-like pattern in which the motion is almost, but not entirely, confined to a thin meandering "jet" stream about 1 cm wide. The transition between these two regimes occurs quite sharply at $\Theta = \Theta_{crit} = 1.58 \pm 0.05$. The wave pattern drifts relative to the rotating system at a uniform angular rate, in the same direction as that of the flow in the top surface "jet" stream, westward or eastward according as the sign of $(T_b - T_a)$ is negative or positive. The wave-number m increases as Θ decreases from Θ_{crit} until m reaches the value for which the wave amplitude is about 2/3 of the wavelength when no further increase in m can be produced by reducing Θ. At this point the pattern gives way to a steady repeating fluctuation termed "vacillation". At lower values of Θ rapid and complicated turbulent fluctuations arise. It is pointed out that the phenomena have their counterparts in the general circulation of the earth's atmosphere, which is thermally driven by solar radiation and influenced by the earth's rotation. Specific measurements are described, including heat transport and the thermal structure of the flow field. It is shown theoretically that Θ may be tentatively identified with appropriate Rossby and Richardson numbers, and a certain measure of agreement is found between the experimental measurements and some of the results of the theories of Davies (see Abstr. 7176/1956) and Kuo (Proceedings of the first symposium on the use of models in geophysical fluids dynamics. Ed. R.R.Long, 1953).

S.Weintroub

532.517

6690. VISCOUS FLOW OF LIQUIDS AT CONSTANT VOLUME AND CONSTANT PRESSURE. J.D.MacKenzie.
J. chem. Phys., Vol. 28, No. 6, 1037-9 (June, 1958).

The energy of activation for viscous flow at constant volume, E_v, is dependent on the volume of a liquid. For normal liquids at elevated temperatures, E_v is only a small fraction of the value of the activation energy at constant pressure, E_p. However, for associated liquids, on account of the presence of hydrogen bonds, E_v is almost equivalent to E_p. It is suggested that in highly associated liquids like liquid silica and some molton glases where flow necessitates the rupture of bonds of even greater energy, the difference between E_v and E_p should be negligible. A.

532.517.4

6691. MEASUREMENTS OF PRESSURE FLUCTUATION IN THE WAKE OF CYLINDER. Y.Kobashi.
J. Phys. Soc. Japan, Vol. 12, No. 5, 533-43 (May, 1957).

To observe the pressure fluctuations an apparatus was constructed using a condenser microphone as a transducer with a ratio-discriminator. The frequency response of the apparatus was calibrated by means of Kármán vortices produced by a circular cylinder. The Helmholtz resonance and the loss in the pressure duct were compensated electrically by a band-rejection filter and a h.f. booster, thereby making the overall frequency-response of the apparatus flat between 50 and 1500 c/s. The apparatus, used in combination with a single rotary-type hot-wire anemometer, proved successful in determining the intensity of the static pressure fluctuation, as well as the correlation between pressure and velocity fluctuation: consequently all the terms in the energy equation became measurable. The energy equation for the fluctuating quantities was ascertained experimentally in the wake of a circular cylinder, 1 cm in diameter, placed in an airstream having a speed of 14 m/s, at a section 42 times the cylinder diameter downstream. A.

532.528 : 534.321.9

6692. QUALITATIVE OBSERVATIONS OF CAVITATION BUBBLES IN A LIQUID SUBJECTED TO ULTRASOUND AND A VARIABLE GAS PRESSURE. M.Degrois.
Ricerca sci., Vol. 27, No. 3, 707-20 (March, 1957). In French.

The liquid studied was 95% ethyl alcohol, chosen because of its excellent transmission of ultrasound, while the gas was CO_2, selected because of its facility for dissolving in liquids. The liquid was held in a prismatic container 3.5 cm high and the ultrasound was transmitted from one face at 1.01 Mc/s. Cavitation was made visible by a diffraction technique. The quantity of cavitation bubbles formed and rising to the surface, as well as their size, was directly proportional to the power fed into the liquid via the transducer. The bubbles formed at a certain distance from the transducer and the zone of formation moved towards the liquid/gas interface as the ultrasonic power was reduced. At low power, only a few bubbles were formed and they were very small. The height of the centre of the zone of bubble formation, as well as the size of the bubbles and their distribution were found dependent on the gas pressure and formulae were deduced to fit the results. A.C.Whiffin

532.54

6693. ON THE STABILITY OF FLOW IN TUBES OF SLOWLY VARYING SECTION. J.Naze.
C.R. Acad. Sci. (Paris), Vol. 246, No. 24, 3316-19 (June 16, 1958). In French.

The stability is studied of certain flows of a liquid of infinite electrical conductivity. Certain profiles which are stable for conductors are unstable for non-conductors. S.F.Edwards

532.57

6694. A CONSTANT LIQUID FLOW DEVICE. G.H.Laycock.
Brit. J. appl. Phys., Vol. 9, No. 8, 333-5 (Aug., 1958).

The theoretical design is given for a device, which passes a constant liquid-flow irrespective of wide viscosity variations, consisting of an orifice in series with a capillary restrictor. A device based on this design is described and experimental results showing that a constant flow is obtained are quoted. An alternative means of rendering the flow automatically independent of viscosity is suggested. A.

532.612.4

6695. THEORETICAL SURFACE TENSION OF Ti, Zr, AND Hf. D.McLachlan, Jr.
J. appl. Phys., Vol. 29, No. 7, 1134 (July, 1958).

See Abstr. 2175 (1958). Various experimental values are compared with a theoretical equation.

532.64 : 535.417

6696. STUDY OF THE ANGLES OF CONTACT OF LIQUID SURFACES WITH SOLID SURFACES BY THE INTERFERENCE OF POLARIZED LIGHT. M.Françon and Y.Gandon.
C.R. Acad. Sci. (Paris), Vol. 246, No. 6, 922-4 (Feb. 10, 1958). In French.

The deformation of a liquid surface induces deformation in a light wave. The wave is then doubled by a birefringent system. The two separated waves are made to interfere by a polarizer and an analyser. The technique permits measurement of the angle of contact and the surface tension. In the method, a plate is immersed vertically in a liquid and the deformation of the light wave passing the contact region is studied. The theory is given permitting derivation of the surface tension and the angle of contact. The method is also applicable to an immersed cylindrical filament and can be used for studying the meniscus formed on the surface of water by certain insects. S.Tolansky

MOLECULAR THEORY OF LIQUIDS

532.7 : 533.7

6697. TRANSPORT PHENOMENA IN A DENSE GAS OF RIGID SPHERES. J.S.Dahler.
J. chem. Phys., Vol. 27, No. 6, 1428-9 (Dec., 1957).

Recently there have been attempts to evaluate liquid transport coefficients, in terms of the equilibrium distribution functions, by Collins and Raffel (Abstr. 108/1955) and by Longuet-Higgins and Pople (Abstr. 1945/1957). The present author attempts to evaluate these theories by using them in conjunction with Enskog's hard-sphere theory. Results indicate that the assumption of equilibrium distributions is likely to lead to errors of the order of 50%.

R.O.Davies

532.7

6698. EQUATION OF STATE FOR WATER AT HIGH PRESSURE. L.Knopoff.
J. chem. Phys., Vol. 28, No. 6, 1067-9 (June, 1958).

An equation of state is derived by assuming water to be an amorphous mixture of Thomas–Fermi–Dirac oxygen atoms and Wigner–Huntington hydrogen atoms, the mixture having the correct proportion of atomic constituents. Comparison is made with more intricate models in which interaction of the fields among neighbours is assumed. A.

532.7

6699. HOLES AND CELLS IN LIQUIDS. T.L.Hill.
J. chem. Phys., Vol. 28, No. 6, 1179-82 (June, 1958).

A certain amount of exact information about cells and holes in liquids can be deduced from the radial distribution function. For example, for cells small enough so that they cannot contain more than one molecule, one can find the radial distribution function around an occupied cell or around a hole (empty cell), the probability that a cell near a molecule will be occupied, and the probabilities for occupancy or nonoccupancy of pairs of cells near each other. Also, the probability that a cell of arbitrary size will be empty can be calculated. Examples are given using an experimental radial distribution function for liquid argon. A.

532.7

6700. THE STRUCTURE OF LIQUID POTASSIUM. O.S.Lashko.
Ukrayin. fiz. Zh., Vol. 1, No. 4, 403-6 (1956). In Ukrainian.

An X-ray study was made of liquid potassium over a temperature range 100° to 300° C, using monochromatic Mo K_α radiation from cylindrical specimens. The curves of atom distribution are calculated by a harmonic method. Analysis of these shows a similarity with liquid sodium. From the measurement of position and area of the first maximum of the curve of atom distribution the coordination number and the radius of the coordination sphere are determined. At 100° C the coordination number is 10 and the distance between the nearest atoms is 4.7 A. With rise of temperature to 300° C the radius increases slightly and the number is decreased to 9. C.R.S.Manders

532.7

6701. THE STRUCTURE OF LIQUID MERCURY.
A.F.Skrȳshevskȳĭ, D.M.Karlȳkov and D.P.Karlȳkova.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 49-53 (1957). In Ukrainian.

X-radiograms were obtained in Cu monochromatic radiation at room temperature. The intensity curves obtained were similar to those obtained by other workers. The radial distribution function has distinct maxima for values of r = 3.12, 4.1, 6.1 A — a result identical with that found by neutron diffraction. The authors conclude that the distribution of atoms at room temperature in Hg does not coincide exactly with that found in the solid state. The most probable distance between adjacent atoms is regarded as 3.12 A and the mean coordination number is ~ 8. C.R.S.Manders

532.7

6702. THE THIRD CONFERENCE ON THE LIQUID STATE OF MATTER. H.P.Roshchȳna and Yu.I.Shȳmans'kyĭ.
Ukrayin. fiz. Zh., Vol. 2, No. 3, 292-5 (1957). In Ukrainian.

Report of a conference held in Kiev State University, 17-24 May 1957. Eighteen authors communicated papers dealing with the properties of liquid metals, alloys, and semiconductors including experimental and theoretical studies X-ray, acoustic, electrical resistance, diffusion properties. Six authors dealt with electrolytes such as NaCl, KCl, NaOH and KOH. One paper considered H_2O, D_2O, HDO. Some twelve authors made communications covering relaxation and viscosity. No other specific publication is to be devoted to the transactions. C.R.S.Manders

532.71

6703. THERMAL MEMBRANE POTENTIAL. T.Ikeda.
J. chem. Phys., Vol. 28, No. 1, 166-7 (Jan., 1958).

The junction of two identical half-cells is a collodion membrane about 0.1 mm thick and shown to have an ionic semipermeability practically perfectly cationic. A well defined change in temperature at the membrane was achieved by spouting against the respective sides of the membrane two aqueous solutions of KCl of equal concentration but at different temperatures. The e.m.f. of the cell is a linear function of the temperature difference with a slope of 0.052 ± 0.014 mV per degree (low temperature side being the positive pole). A brief theoretical interpretation is given. W.Good

532.72

6704. CONTRIBUTION TO THE THEORY OF ELECTRO-DIFFUSION. T.A.Bak and W.G.Kauman.
J. chem. Phys., Vol. 28, No. 3, 509-10 (March, 1958).

The treatment of Mysels (Abstr. 4059/1956) is replaced by one based on the complete diffusion equation. It is shown that the two diffusion processes (corresponding to diffusion in the presence and the absence respectively of the electrical field) are asymptotically independent in a restricted sense only. S.J.Gregg

532.72

6705. STUDIES OF HIGH POLYMERS BY RADIOACTIVE METHOD. II. SELF-DIFFUSION OF POLYSTYRENE IN ITS DILUTE SOLUTION. S.Sugai and J.Furuichi.
J. Phys. Soc. Japan, Vol. 12, No. 4, 369-73 (April, 1957).

For Pt I, see Abstr. 1673 (1956). The self-diffusion was studied by use of C^{14}-labelled polystyrene, and the dependence of the self-diffusion coefficient of polystyrene upon its molecular weight was determined. From the results, the molecular extension, the shielding ratio, and other molecular quantities of the polystyrene molecule in the dilute solution were calculated by use of the diffusion theory of Debye and Bueche, and compared with the data obtained by other methods. A.

532.73

6706. ELECTRON IN LIQUID AMMONIA. R.A.Stairs.
J. chem. Phys., Vol. 27, No. 6, 1431-2 (Dec., 1957).

Theoretical. Reports calculations on the electron cavity model for metal–ammonia solutions, using a finite spherical well. Good results are obtained by taking surface tension to be less for the cavity than for a plane surface, but without needing to introduce other complicating effects. See Abstr. 2245 (1953). J.Hawgood

532.77

6707. ON THE THEORY OF ELECTRONIC PROCESSES IN METAL–AMMONIUM SOLUTIONS. M.F.Deigen and Yu.A.Tsvirko.
Ukrayin. fiz. Zh., Vol. 1, No. 3, 245-60 (1956). In Ukrainian, with summary (2 p.) in Russian.

A statistical calculation is made of the equilibrium concentration of polarons and local centres in an inertia-polarizing dielectric, the energy of the plasma being taken into account in Debye–Hückel approximation, and a theory of the electronic processes in metal–ammonium solutions is built up on it. An expression is derived for the temperature variation of the atomic magnetic susceptibility coefficient of a solution, the paramagnetic component being the sum of the concentration of polarons and F-centres and the diamagnetic component being the concentration of F_2 centres. Also given is a quantitative explanation of the peculiar variation with concentration of the equivalent electrical conductivity based on the generalized model, developed in the paper, for a solution in which the basic current carriers are taken to be polarons. C.R.S.Manders

532.77 : 536.75

6708. PARTIAL MOLAL ENTROPIES OF IONS IN AQUEOUS SOLUTION. P.C.Scott and Z.Z.Hugus, Jr.
J. chem. Phys., Vol. 27, No. 6, 1421-3 (Dec., 1957).

Criticisms made by Laidler (Canad. J. Chem., Vol. 34, No. 8, 1107-13, Aug. 1956) of the Powell–Latimer equation (Abstr. 8566/1951), for calculation of the entropies of aqueous monatomic ions, are discussed and the success of this empirical equation in fitting experimental data is pointed out. G.I.W.Llewelyn

532.77 : 536.75

6709. COMMENTS ON "PARTIAL MOLAL ENTROPIES OF IONS IN AQUEOUS SOLUTION" BY P.C.SCOTT AND Z.Z.HUGUS.
K.J.Laidler.
J. chem. Phys., Vol. 27, No. 6, 1423-4 (Dec., 1957).

See preceding abstract. The author agrees that the Powell–Latimer equation gives close agreement with experimental results, but this advantage is offset by the use of a third parameter, thereby reducing the value of the equation in the development of the theory of ions in solution. G.I.W.Llewelyn

532.77 : 541.64

6710. THEORY OF DILUTE HIGH-POLYMER SOLUTIONS.
D.K.Carpenter and W.R.Krigbaum.
J. chem. Phys., Vol. 28, No. 3, 513-14 (March, 1958).

The connection between previous theories (Abstr. 9083 '1950; J. Amer. Chem. Soc., Vol. 75, 1775, 1953 and Vol. 76, 3758, 1954) is discussed, and an earlier calculation (Abstr. 1501 1945) is repeated. It is concluded that the two aforementioned theories failed to consider the physical contiguity of the successive chain segments. P.Gray

532.77

6711. COMMENTS ON THE PAPER "POTENTIOMETRIC TITRATION, ASSOCIATION PHENOMENA, AND INTERACTION OF NEIGHBORING GROUPS IN POLYELECTROLYTES".
S.A.Rice and F.E.Harris.
J. chem. Phys., Vol. 28, No. 5, 988-9 (May, 1958).

It is pointed out that Lifson (Abstr. 5109 '1957) has provided an

exact method for the treatment of polymer models whereas the present authors had given an approximate method. It is maintained that the available evidence is not consistent with the view that because the dissociation constants of salts of the class R.COONa are large, site binding is negligible. W.Good

532.77

6712. ON ION-PAIR FORMATION IN POLYELECTROLYTES. S.Lifson.
J. chem. Phys., Vol. 28, No. 5, 989-90 (May, 1958).

The two comments by Harris and Rice (preceding abstract) are discussed. With the first the author is in agreement but only in respect of a corollary of his main result giving the dependence of the degree of dissociation and cation binding on the intrinsic dissociation constants, neighbour-interaction energies, and activities of H^+ and metallic cations. Concerning the second it is pointed out in detail that while the idea that strong neighbour interactions may cause ion-pair formation is very important it is not sufficiently established that it applies to polyacrylic and polymethacrylic acids. W.Good

532.77

6713. ON THE EFFECTIVE DIFFUSION TENSOR OF A SEGMENT IN A CHAIN MOLECULE AND ITS APPLICATION TO THE NON-NEWTONIAN VISCOSITY OF POLYMER SOLUTIONS. Y.Ikeda.
J. Phys. Soc. Japan, Vol. 12, No. 4, 378-84 (April, 1957).

The effect of hydrodynamic interaction between segments in a chain molecule plays an important role in the theory of the intrinsic viscosity of high polymer solutions. In this paper, the effect of hydrodynamic interaction is reflected into the concept of the effective diffusion tensor of a segment in a chain molecule. In performing the calculation, r_{IG}, the distance from the centre of gravity of the chain molecule to the segment, is considered as a parameter. As a result, each segment has an anisotropic effective diffusion tensor, the radial component of which is about 10% larger on the average than the transversal ones. With this anisotropic diffusion tensor, the shear gradient dependence of the intrinsic viscosity of polymer solutions is deduced, making use of the Rouse model. The agreement with experiments is satisfactory. A.

MECHANICS OF GASES

533.16 : 536.23 : 536.633

6714. COMMENTS ON THE SENFTLEBEN METHOD FOR THE DETERMINATION OF THE HEAT CONDUCTIVITY, THE SPECIFIC HEAT, AND THE VISCOSITY OF GASES. S.Arajs and S.Legvold.
J. appl. Phys., Vol. 29, No. 6, 1001 (June, 1958).

Experimental data taken from tables were used to compute values for a number of gases for comparison with Senftleben's correlation curve (Abstr. 5896/1953). Considerable disagreement is found particularly for H_2. Hence the Senftleben method cannot provide reliable values of the viscosity. S.Weintroub

533.16

6715. HIGH-TEMPERATURE GAS VISCOSITIES. I. NITROUS OXIDE AND OXYGEN. C.J.G.Raw and C.P.Ellis.
J. chem. Phys., Vol. 28, No. 6, 1198-200 (June, 1958).

The viscosity of nitrous oxide was measured in the temperature range of 100 to 1000°C. A specially constructed transpiration apparatus of fused silica was used. Results at the lower temperatures show very close agreement with those of other workers, the viscosity behaving normally up to about 550°C, above which the thermal decomposition of nitrous oxide becomes significantly large. Experimental data on the viscosity of dissociating nitrous oxide at high temperatures up to 1000°C are discussed. Viscosity results for oxygen at temperatures higher than those previously reported (i.e., above 800°C) are also included. The molecular interaction parameters for both nitrous oxide and oxygen are calculated in the higher temperature ranges. A.

533.16

6716. THE VISCOSITY OF GASEOUS He, Ne, H_2 AND D_2 BELOW 80°K. J.M.J.Coremans, A.van Itterbeek, J.J.M.Beenakker, H.F.P.Knaap and P.Zandbergen.
Physica, Vol. 24, No. 7, 557-76 (July, 1958).

Measurements are reported of the coefficient of viscosity of He, Ne H_2 and D_2 between 20 and 80°K, using an oscillating disk viscometer. A simple thermostat, developed for this purpose, is also described. The results are in good agreement with the existing data below 20°K and above 60°K. In the course of the measurements a heretofore omitted correction of the oscillating disk measurements was found. With the aid of this correction, the existing discrepancies in the viscosity data below 4°K could be greatly reduced. Corrected values for the viscosity coefficient are given. The experimental results are compared with theoretical predictions based on the quantum-mechanical modification of the law of corresponding states. The first term of the series expansion of the reduced viscosity in powers of the de Broglie parameter is determined from the experimental data. Furthermore, the data are compared with calculations, based on different models for the intermolecular potential. A.

533.16 : 533.12

6717. ON THE CORRELATION OF EXPERIMENTAL VISCOSITY DATA. J.Kestin and H.E.Wang.
Physica, Vol. 24, No. 7, 604-8 (July, 1958).

The paper gives empirical correlations for low-density viscosity with temperature and viscosity excess with density, for carbon dioxide (measured by Michels, Botzen and Schuurman [Abstr. 8455/1957]) and nitrogen (measured by Lazarre and Vodar [Conference on thermodynamic and transport properties of fluids at the Institution of Mechanical Engineers, July, 1957, London; Abstr. 156/1957]). It is shown that in carbon dioxide, the correlation breaks down around the critical point, but otherwise includes the whole range of states from liquid to gaseous. In the case of nitrogen, the correlation seems to break down at the higher densities for lower temperatures. Smoothed values for the viscosity of carbon dioxide are given. A.

533.5

6718. LEYBOLD'S VACUUM POCKET-BOOK FOR LABORATORIES AND INDUSTRY. [Leybold Vakuum-Taschenbuch für Laboratorien und Betrieb.] K.Diels and R.Jaeckel.
Berlin/Göttingen/Heidelberg: Springer-Verlag (1958) viii+ 270 pp. In German.

The book provides comprehensive data based on a minute scrutiny of the literature (53-page bibliography) and on the long experience of Leybold. It is divided into fifteen chapters, beginning with a summary in tabular and graphical form of the most useful formulae and results of the kinetic theory of gases. General problems of pumping are then discussed, including the use of gas ballast and cold traps for pumping condensible vapours. A section of the book is concerned with the measurement of pressure and the detection of leaks. The information is here arranged in a form most convenient for the designer of a complete vacuum system, guidance being given at each stage on the choice of the appropriate pump or gauge. The second half of the book is concerned with design problems in metallurgy, freeze-drying, and vacuum impregnation. Extensive tables are provided of physical properties relevant to vacuum engineering. T.Mulvey

533.51

6719. THE ULTIMATE PRESSURE OF OIL DIFFUSION PUMPS, WITH SPECIAL REFERENCE TO THE VAPOUR PRESSURE OF THE WORKING FLUID. G.Reich.
Z. angew Phys., Vol. 9, No. 1, 23-9 (Jan., 1957). In German.

By measuring the variation of pressure with temperature in a vessel pumped by an oil diffusion pump it is possible to distinguish the separate contributions to the ultimate pressure from (a) the vapour pressure of the oil and (b) the residual gas pressure due to other causes. An apparatus of the type described by Blears (Abstr. 776/1947) is used to investigate in this way the ultimate pressure obtained with various currently available pump oils. T.Mulvey

533.56

6720. A HYDROGEN CONDENSATION PUMP. B.H.Lazaryev, Ye.S.Borovȳk, M.F.Fedorova and N.M.Tsȳn.
Ukrayin. fiz.Zh., Vol. 2, No. 2, 175-82 (1957). In Ukrainian, with summary (½ p.) in Russian.

A method is described of attaining high vacua (10^{-8} to 10^{-9} mm Hg) by the condensation of noble gases on a surface cooled to liquid hydrogen temperature. The construction of two pumps is given, with pumping rates of 13 000 and 4000 litres/sec, respectively. C.R.S.Manders

533.6.011

6721. THE ONE-DIMENSIONAL AND TWO-DIMENSIONAL GAS DYNAMICS ANALOGIES. R.A.A.Bryant.
Austral. J. appl. Sci., Vol. 7, No. 4, 296-313 (Dec., 1956).

A study is made, using inviscid theory, of a supposed "general" analogy between high-speed gas flow and super-critical open-channel flow, and the possibility of using it for the investigation of two-dimensional transonic flows is explored. It is shown, that the "general" analogy is theoretically applicable to one-dimensional

transonic flow only and that there is only one satisfactory basic two-dimensional analogy; the conditions under which this two-dimensional analogy is mathematically valid are found to extend to unsteady rotational gas flows with weak shocks. Some of the conditions are considered which must be met in a physical analogy and shows that, in practice, the method must be based on an a priori assumption of validity if curved shocks are involved. A.

MOLECULAR THEORY OF GASES

533.7

6722. ON A NEW ISOTHERMAL CONSTANT OF GASES.
G.Paoluzi.
Ann. Geofis., Vol. 10, No. 3-4, 241-5 (July-Oct., 1957). In Italian.

For a gas with molecular association it is deduced that $RT[RT/(v - b) - (p + a/v^2)]/(p + a/v^2)^2$ is, to the first approximation, a function of temperature only and thus possesses the property of an equilibrium constant. This is confirmed by considering the numerical data for thirty isotherms relating to five gases: neon, nitrogen, oxygen, carbon dioxide and methane. S.Weintroub

533.7

6723. ON THE CALCULATION OF THE CONSTANTS OF LENNARD-JONES POTENTIALS. R.Gibert and A.Dognin.
C.R. Acad. Sci. (Paris), Vol. 246, No. 18, 2607-9 (May 5, 1958). In French.

The constants are calculated to an accuracy ~ 1% by least square fits to experimental data for Ne, A, O_2, N_2, air, CO, CO_2, and CH_4, using collision integral values of Hirschfelder et al. (Molecular Theory of Gases and Liquids. Hirschfelder, Curtiss and Bird. New York: John Wiley, 1954). P. Gray

533.7

6724. THE EFFECT OF THE DISSOLVING OF MERCURY ON THE MEASUREMENT OF THE EQUATION OF STATE OF A COMPRESSED GAS BY THE INTERNAL HEAT METHOD (SAUREL'S METHOD). R.Bergeon.
J. Rech. Cent. Nat. Rech. Sci., No. 37, 371-3 (Dec., 1956). In French.

The experimental method is described and the correction for nitrogen is shown graphically over a temperature range of 300 to 1300°K for densities up to 7 mole/litre. The correction $\Delta p/p$ is approximately 10^{-4}. H.C.Cole

533.7

6725. KINETIC THEORY OF LINEAR SHEAR FLOW.
E.P.Gross and S.Ziering.
Phys. of Fluids, Vol. 1, No. 3, 215-24 (May-June, 1958).

The flow of a monatomic gas between two parallel plates kept at the same temperature and moving in opposite directions is studied. The relative velocity of the plates is much smaller than the speed of sound. The deviation from the equilibrium distribution, $\phi(c, x)$, satisfies the linearized Boltzmann equation. The customary boundary conditions are adopted in which a fraction of the molecules is specularly reflected and the rest emitted with a Maxwellian distribution characteristic of the plate. The method consists of setting $\phi = \phi^+$ for $c_x > 0$ and $\phi = \phi^-$ for $c_x < 0$ so that positive and negative velocities are distinguished. $\phi^\pm = a_0^\pm(x)c_z + a_1^\pm(x)c_z c_x$. The space functions are determined by taking half-range velocity moments of the Boltzmann equation. Explicit results for the distribution function, flow velocity and stress are given for a general law of force. Numerical results are worked out for hard sphere molecules. The method treats both microscopic boundary conditions and conservation laws exactly. Precise results are obtained both for the low-pressure region and for the high-pressure coefficient of viscosity. The region of slip flow is analysed. Maxwell's slip condition is remarkably close to the condition obtained here from the kinetic theory. In this region of pressures, the deviations from the velocity profile of the hydrodynamic slip flow theory are everywhere very small, and are completely negligible at distances greater than $\frac{1}{8}$ of a mean free path from a plate. A.

533.7

6726. NOTE ON THE DEDUCTION OF THE EQUATIONS OF MOTION IN THE THIRD APPROXIMATION, GIVEN IN CHAPMAN'S MONOGRAPH. Yu.P.Lun'kin.
Zh. tekh. Fiz., Vol. 28, No. 4, 913-14 (1958). In Russian.

An error is found and corrected in the calculation of the viscosity stress tensor (see Mathematical Theory of Non-uniform Gases, S.Chapman and T.G.Cowling. Cambridge: University Press, 1939, pp. 261-5). This error has a considerable effect in the Barnett–Chapman equation, in particular in the term representing the stress changes across a boundary layer. M.J.Kearsley

VIBRATIONS. ACOUSTICS

534

6727. ALL-UNION ACOUSTICS CONFERENCE.
V.A.Krasil'nikov.
Akust. Zh., Vol. 4, No. 1, 105-6 (1958). In Russian.

The All-Union Acoustics Conference, organized by the Academy of Sciences of the U.S.S.R. and by Moscow University, was held in Moscow on 24-29 June 1957. About 150 papers on the following subjects were presented: propagation of sound in non-homogeneous media, production and diffraction of sound, waves of finite amplitude, physics of the ultrasound, musical acoustics, physiological acoustics and speech. S.Chomet

534.131

6728. SOME CHARACTERISTICS OF THE FLEXURAL VIBRATIONS OF ORTHOGONALLY STIFFENED CYLINDRICAL SHELLS.
W.H.Hoppmann,II.
J. Acoust. Soc. Amer., Vol. 30, No. 1, 77-82 (Jan., 1958).

A résumé is presented of a theoretical study of the problem of flexural vibrations of the walls of orthogonally stiffened cylindrical shells. Frequency equations are given for the stiffened shells. In addition an experimental method of verifying the theory is described. Experimentally determined frequencies for an isotropic as well as two different designs of orthogonally stiffened shells are given in tables. The experimental and corresponding theoretical results are discussed. A peculiar dip in the frequency spectrum which was discovered by Arnold and Warburton for uniform isotropic shells is shown to exist theoretically and is verified experimentally for stiffened shells. In addition, there is shown to be a bias in the excitability of the modes of vibration as determined experimentally. The reason for this phenomenon is discussed. The principal axes of stiffness are in the longitudinal and transverse directions for the shells under study. In one case the axis of maximum stiffness is in the longitudinal direction and in the other case it is in the transverse direction. As the stiffness tensor is the same for the two cases, except for orientation, an opportunity is provided for examining the effect of rotating the stiffness axes through 90°. A.

534.131

6729. FLEXURAL VIBRATIONS OF STIFFENED CYLINDERS.
G.D.Galletly.
J. Acoust. Soc. Amer., Vol. 30, No. 7, 644 (July, 1958).

Commenting on the paper by Hoppmann (see preceding abstract), the author points out that the anomaly in the vibration frequencies of unstiffened cylinders also exists for ring-stiffened cylinders, as was first shown by H.H.Bleich. For ring-stiffened cylinders, Bleich's approach requires a 5×5 matrix (if inter-ring deformation is considered) whereas Hoppmann's method, which neglects inter-ring deformation, has only a 3×3 matrix. The experimental frequencies given in Table 1 of Hoppmann's paper are usually lower than the theoretical frequencies, whereas the author's calculations showed that the theoretical frequencies for a 5×5 matrix are higher than those for a 3×3 matrix. The author therefore queries whether Hoppman's method adequately accounts for the inter-ring deformation in the vibrations of ring-stiffened cylinders. H.J.H.Starks

534.132

6730. NONLINEAR OSCILLATIONS OF A COLUMN OF GAS.
R.Betchov.
Phys. of Fluids, Vol. 1, No. 3, 205-12 (May-June, 1958).

Several authors have studied experimentally the motion of a column of air in a long pipe, closed at one end and driven at the other by an oscillating piston. At resonance, they observed shock waves travelling in the tube. The paper presents a simple theoretical analysis of the motion, based on discontinuous linearized solutions and a secular equation. This equation guarantees that the motion remains periodic in spite of the cumulative effects of the nonlinear terms. For an inviscid gas, the amplitude at resonance is found to be finite and to be determined by nonlinear effects. This differs from previous results of Frederiksen. Friction can be taken into account. It is included in the final results, which are presented in the form of a chart. A.

534.133 : 535.417

MULTIPLE-BEAM INTERFEROMETRIC STUDIES ON OSCILLATING QUARTZ CRYSTALS. See Abstr. 5810

534.152 : 535.417

6731. APPARATUS FOR MEASURING VERY SMALL DISPLACEMENTS OF VIBRATING CRYSTALS. A.A.Fotchenkov.
Kristallografiya, Vol. 2, No. 5, 653-7 (1957). In Russian.

The apparatus works on the principle of modulation interferometry (Abstr. 5417/1953). It measures displacements of the order of 0.05 A and is intended for the measurement of piezoelectric and electrostriction coefficients of crystals at temperatures from −20 to 100°C and frequencies from 20 to 26 000 c/s. Measurement of the d_{11} coefficient of quartz gives good agreement with previous results. R.F.S.Hearmon

534.2

6732. RAYLEIGH-TYPE WAVES ON CYLINDRICAL SURFACES. I.A.Viktorov.
Akust. Zh., Vol. 4, No. 2, 131-6 (1958). In Russian.

The problem is examined of elastic surface-waves propagating over a cylindrical surface in a direction perpendicular to that of formation. C.R.S.Manders

534.2 : 535.329

6733. ELECTRICAL POLARIZATION OF ELASTIC WAVES IN CRYSTALS AND OPTICAL DISPERSION. Y. Le Corre.
Rev. mod. Phys., Vol. 30, No. 1, 229-31 (Jan., 1958).

The formula obtained by Lydanne, Sachs and Teller (Abstr. 1283/1941) for the ratio of the longitudinal to transverse frequency overestimates the ratio for the case of a fluorite crystal (1.8 instead of 1.3). The author explains this discrepancy by proposing a new formula taking into account the electric polarization created by acoustical and Raman vibration modes. The theory is developed in detail for the special case of fluorite. R.Bullough

534.2 : 550.34

6734. GRAPHO-ANALYTICAL METHOD OF FREQUENCY ANALYSIS OF SEISMIC WAVES OVER A WIDE RANGE OF FREQUENCIES. F.M.Gol'tsman.
Vestnik Leningrad Univ. (1957), No. 22, Ser. Fiz. Khim., No. 4, 76-88. In Russian.

The method is an improvement on one put forward by the author in same journal (1956) which suffered from the defect of being able to cope indifferently with higher frequencies. The complex spectrum is represented as a Fourier series the coefficients of which are the discrete values of a given function whilst special nomograms are given for summing the series. C.R.S.Manders

534.2 : 534.321.9 : 539.382

ELASTIC PROPERTIES OF ICE. See Abstr. 6453

534.213

6735. AN EXPERIMENTAL INVESTIGATION OF THE WAVE PROPERTIES OF A MEDIUM WITH CYLINDRICAL CHANNELS. A.E.Vovk, R.N.Pasternak and V.V.Tyutekin.
Akust. Zh., Vol. 4, No. 1, 24-32 (1958). In Russian.

The experimental work was carried out on a rubber-like material. A method is given for calculating the complex wave-number from measurements of the complex impedance of a specimen. Results are given for a series of experiments with various sizes channels, and compared with theoretical estimates.

C.R.S.Manders

534.22 : 532.7

6736. THE MOLECULAR THEORY OF THE VELOCITY OF SOUND IN LIQUIDS. V.K.Prokhorenko and I.Z.Fisher.
Akust. Zh., Vol. 4, No. 2, 204-5 (1958). In Russian.

Theoretical paper and a successor to Abstr. 3804 (1958). The liquid is considered as a system of solid non-interacting spheres of arbitrary density, the model in fact of a strongly compressed gas. The velocity of sound is shown to increase with increase of density and at limitingly high densities the velocity is approximately five times the value in an ideal gas.

C.R.S.Manders

534.22 : 532.7

6737. VISCOSITY CORRECTION FOR THE SOUND VELOCITY MEASURED BY A RESONANCE METHOD.
C.Sălceanu and M.Zăgănescu.
C.R. Acad. Sci. (Paris), Vol. 246, No. 18, 2589-91 (May 5, 1958). In French.

The theoretical value for this correction is deduced for the propagation in a liquid in a tube. H.D.Parbrook

534.22 : 532.7

6738. SONIC VELOCITY IN LIQUID PARAFFINS. H.I.Leon.
J. chem. Phys., Vol. 28, No. 4, 748-9 (April, 1958).

This was measured in octane, decane, dodecane and tetradecane, in the ranges from 20° to 45° C and from 200 to 500 kc/s with a fixed path interferometer (Abstr. 141/1956). An accuracy of ±1 m/s and ±0.2 deg C is claimed. The molar velocity increment for the $-CH_2-$ bond is calculated with Rao's formula and the mean value agrees approximately with other work. H.D.Parbrook

534.22 : 532.7

6739. EFFECT OF VARIATION OF THE DIELECTRIC CONSTANT OF THE SOLVENT ON SOUND ABSORPTION IN $MnSO_4$ SOLUTIONS. S.K.Kor.
Naturwissenschaften, Vol. 45, No. 11, 261 (1958).

Absorption measurements are reported in $MnSO_4$ solutions, with water–dioxane mixtures as solvents of varying dielectric constant, and support the theory that the excess absorption is due to a dissociation-type process. H.D.Parbrook

534.222.1 : 533.6.011.32

6740. STRUCTURE OF A CENTERED RAREFACTION WAVE IN A RELAXING GAS. W.W.Wood and F.R.Parker.
Phys. of Fluids, Vol. 1, No. 3, 230-41 (May-June, 1958).

The structure of a centred rarefaction wave in a relaxing ideal gas is studied theoretically, both analytically and numerically, with neglect of the Navier–Stokes terms (viscosity, etc.) in the hydrodynamic equations. The role of the "frozen" sound speed is clarified, in that it is shown that there is a transition from "frozen" flow at short times to equilibrium flow at long times. A.

534.222.2

6741. A NEW RELATION IN THE HYDRODYNAMICAL THEORY OF EXPLOSIVE WAVES. N.Manson.
C.R. Acad. Sci. (Paris), Vol. 246, No. 20, 2860-2 (May 19, 1958). In French.

By expressing the partial derivatives of the velocity of a Chapman–Jouguet explosion as functions of the volume and temperature or pressure of the initial and final states, the equation of state of the products is found in terms of the properties of the explosive. P.Gray

534.222.2 : 537.564

6742. FURTHER COMMENTS ON IONIZING SHOCK WAVES IN MONATOMIC GASES. W.J.Guman.
J. appl. Phys., Vol. 29, No. 1, 109 (Jan., 1958).

Reply to criticism by Alpher (Journal of Fluid Mechanics, Vol. 2, Pt 2, 123, 1957) about approximations. Lists gas dynamical parameters for normal shocks in argon over range Mach 10 to 18.

A.G.Gaydon

534.222.2

6743. ELECTRICALLY DRIVEN SHOCK TUBE.
D.E.Bloxsom, Jr.
J. appl. Phys., Vol. 29, No. 7, 1128-9 (July, 1958).

A horn-fibre arc is used to drive strong shocks through high pressure (0.034 to 1.0 atm) air in 33 in. and 11 ft tubes. The circuit is shown. Plots of Mach number and electric output against time are given. The uniformity of the shocks is poor. A.G.Gaydon

534.222.2 : 539.58

6744. SHOCK-WAVE COMPRESSIONS OF TWENTY-SEVEN METALS. EQUATIONS OF STATE OF METALS.
J.M.Walsh, M.H.Rice, R.G.McQueen and F.L.Yarger.
Phys. Rev., Vol. 108, No. 2, 196-216 (Oct. 15, 1957).

An explosive system is used to drive a strong shock wave into a plate of 24ST aluminium. This shock wave propagates through the 24ST aluminium into small test specimens which are in contact with the front surface of the plate. A photographic technique is used to measure velocities associated with the 24ST aluminium shock wave and with the shock wave in each specimen. The measured velocities are transformed, using the conservation relations, to pressure–compression points. Resulting pressure–compression curves are given for 27 metals. The range of data is different for each material but typically covers the pressure interval 150 to 400 kilobars; probable errors in reported experimental pressure–compression curves are 1 or 2% in compression for a given pressure. The experimental curves, which consist thermodynamically of a known P, V, E locus for each material, are used to calculate a more complete high-pressure equation of state. This is done by means of a theoretical estimate of the volume variation of the Grüneisen ratio $\gamma(V) = V(\partial P/\partial E)_V$. Calculated P, V, T states are listed for the various materials. For 24ST aluminium, quantities of application in shock-wave hydrodynamics are also tabulated. A.

534.222.2

6745. RADIATION EFFECTS IN SHOCK-WAVE STRUCTURE. H.K.Sen and A.W.Guess.
Phys. Rev., Vol. 108, No. 3, 560-4 (Nov. 1, 1957).

The equations for shock-wave structure, with the inclusion of radiation effects, are derived. These radiation effects are radiation pressure, radiation energy density, and radiative transfer of energy. Computations are performed for a diffusion approximation of radiation flux and the neglect of radiation energy density and pressure. The results show that the over-all effect of radiation can be taken as a diminution of the Prandtl number, and that the shock width is larger than when viscosity and heat conduction alone are considered. The radiative contribution to the width of the shock is found to depend primarily on the ratio of the mean free path of radiation to that of the material particles. The proportionate increase in shock width is found to be a function of the Mach number and to increase with it. Possible application of the above results to shock-wave propagation in a medium of low density is indicated. A.

534.222.2

6746. SHOCK-FRONT-THICKNESS MEASUREMENTS BY AN ELECTRON BEAM TECHNIQUE. H.N.Ballard and D.Venable.
Phys. of Fluids, Vol. 1, No. 3, 225-9 (May-June, 1958).

An electron beam densitometer is described for investigating the structure of a shock front in low-density gases. The parameters measured by this technique are directly related to those parameters used in the accepted definition of shock front thickness. Hence the interpretation of the data is direct; no model of the shock front structure must be assumed and no theoretical treatment of non-equilibrium flow conditions is needed. An approximate method of data reduction is used for treating preliminary results. The measured value of the thickness of a Mach 4 shock in argon is about three mean free paths, measured in terms of the undisturbed gas. This technique provides a new tool for investigating relaxation phenomena behind shock waves. A.

534.222.2 : 541.126

6747. RELAXATION TIME FOR REACTIONS BEHIND SHOCK WAVES AND SHOCK WAVE PROFILES. R.E.Duff.
Phys. of Fluids, Vol. 1, No. 3, 242-5 (May-June, 1958).

An expression is developed for the relaxation time for the approach to equilibrium for the dissociation of a diatomic gas behind a shock wave. This expression shows the importance of the variation of temperature behind a shock on the rate of approach to equilibrium. Numerical calculations of the shock wave profile in O_2 for two different dissociation mechanisms show that the relaxation time analysis is only appropriate for the description of the dissociation within a few percent of equilibrium. The calculations also show that ozone is not an effective intermediate for the shock dissociation of O_2 and that it is impossible to define a relaxation time for the over-all dissociation process which is inversely proportional to pressure or density. A.

534.222.2

6748. MAGNETIC FIELD EFFECTS ON BOW SHOCK STAND-OFF DISTANCE. R.W.Ziemer and W.B.Bush.
Phys. Rev. Letters, Vol. 1, No. 2, 58-9 (July 15, 1958).

The distance at which a shock wave is formed ahead of a blunt body is increased when a magnetic field is applied. Experimental determinations of the stand-off distance have been made with a shock of Mach number 4.5 and magnetic field strengths up to 35 kilo gauss. The experimental body was a cylinder of 2 cm diameter with a faired nose of 1.2 cm radius. Experimental values are correlated with theoretical ones. E.R.Wooding

534.222.2 : 535.33.03

6749. GLOW OF AIR DURING A STRONG EXPLOSION AND THE MINIMAL BRIGHTNESS EFFECT OF THE FIREBALL. Yu.P.Raizer.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 483-93 (1958). In Russian.

The optical properties of air below 6000° are considered. It is shown that the absorption and radiation of visible light at temperature between 6000° and 2000° are due to the presence of nitrogen dioxide which is formed in air at these temperatures. Some optical effects observed in strong explosions are explained on this basis, such as the glow of air in a shock wave at low temperatures (down to 2000°), separation of the wave front from the boundary of the fireball when the temperature of the front is close to 2000° and also the peculiar effect of minimal brightness of the fireball. A.

534.222.2 : 537.528

6750. IMPULSE SOUND SOURCES, FUNDAMENTALS AND ANALOGY TO EXPLOSIVE TRANSFORMATIONS. F.Früngel and H.Keller.
Z. angew. Phys., Vol. 9, No. 3, 145-7 (March, 1957). In German.

Underwater spark sound sources are compared with small explosive charges. J.M.Hough

534.222.2

6751. SHOCK-WAVE SOURCE WITH SPRING ELECTRODES, PLASTIC OR FLUID LENSES AND A WIRE LENS FOR SHAPING THE WAVE FIELD. F.Früngel, E.Bailitis and W.Thorwart,
Z. angew. Phys., Vol. 9, No. 4, 153-5 (April, 1957). In German.

An experimental arrangement is described for producing shock waves by means of a fluid spark electrode system. The performance of the system when lenses of different design and material are used for controlling the wave field is illustrated with schlieren photographs. H.J.H.Starks

534.222.2 : 537.528

6752. THE SOUND IMPULSE OF A LIQUID SPARK. E.Bailitis.
Z. angew. Phys., Vol. 9, No. 9, 429-34 (Sept., 1957). In German.

The shock waves from a spark produced in water were recorded and studied using a piezoelectric receiver and a c.r.t. The time of growth of the pressure front was measured, as well as the properties of the sound wave in relation to the discharge energy. A theoretical introduction is given and an extensive bibliography. T.C.Toye

534.222.2 : 539.58

COMPRESSION OF DENSE MEDIA BY A SINGLE SHOCK.
See Abstr. 6467

534.222.2.08

6753. ON THE PERFORMANCE OF THIN-FILM GAUGES IN HIGH-TEMPERATURE SHOCK TUBE FLOWS. R.G.Jahn and D.Weimer.
J. appl. Phys., Vol. 29, No. 4, 741-2 (April, 1958).

Resistance strips of platinum paint give anomalous, sometimes negative, changes of resistance for reflected shocks around Mach 5.5 in N_2. The conducting ionized gas is believed to act as a parallel electric circuit, falsifying measurements of resistance of the strip and thus of the heat flux to it. Results are consistent with ionization of pure N_2. A.G.Gaydon

534.23 : 537.312.62

6754. ULTRASONIC ATTENUATION IN SUPERCONDUCTING ALUMINUM. K.L.Chopra and T.S.Hutchison.
Canad. J. Phys., Vol. 36, No. 6, 805-6 (June, 1958).

The attenuation of 20 Mc/s longitudinal ultrasonic waves in normal and superconducting polycrystalline aluminium (purity > 99.99%) was studied between 0.84° and 1.6° K. Comparison with theory was restricted by inability to achieve a low enough temperature. Absorption hysteresis was also noted on the destruction and restoration of superconductivity with a magnetic field. L.Mackinnon

534.23

6755. THE ABSORPTION OF SOUND WAVES OF FINITE AMPLITUDE. A REVIEW. K.A.Naugol'nykh.
Akust. Zh., Vol. 4, No. 2, 115-24 (1958). In Russian.

Calculation shows that the distortion of wave-shape leads to a notable increase of absorption, e.g. a two-fold increase of the absorption coefficient at 100 kc/s in water is easily obtained. The Navier–Stokes' theory is reviewed and deductions from it compared with experiments. C.R.S.Manders

534.23

6756. THE ATTENUATION OF A SOUND BEAM ON TRAVERSING A LAYER HAVING VELOCITY DISCONTINUITY. A.N.Barkhatov and I.I.Shmelev.
Akust. Zh., Vol. 4, No. 2, 125-7 (1958). In Russian.

The results of some experimental measurements are given, together with an evaluation of them in terms of geometrical theory. C.R.S.Manders

534.23

6757. THE PROPAGATION OF FINITE AMPLITUDE WAVES IN A LIQUID. K.A.Naugol'nykh and E.V.Romanenko.
Akust. Zh., Vol. 4, No. 2, 200-2 (1958). In Russian.

An expression is derived for the attenuation coefficient at a distance from a source. Measurements made by a pulse-method (p.r.f. = 50 c/s, pulse duration = 20-40 msec, frequency = 1 Mc/s, peak intensity = 300 W/cm²) in conductivity water are in excellent agreement with theory. C.R.S.Manders

534.23 : 539.32

758. ACOUSTICAL LOSS AND YOUNG'S MODULUS OF TTRIUM IRON GARNET. D.F.Gibbons and V.G.Chirba. hys. Rev., Vol. 110, No. 3, 770-1 (May 1, 1958).

Measurements of the variation of Young's modulus and acoustal attenuation with temperature were made on two samples of olycrystalline yttrium iron garnet using a technique reported by ine (Abstr. 2243/1955). In a sample containing alumina and silica s impurities a stress-induced relaxation was observed. This was nly just resolvable in a second specimen which was within ±0.05% f the stoichiometric composition $Y_3Fe_2(FeO_4)_3$. A smaller ferriagnetic line width in the second sample also suggests that the tress-induced relaxation is not a property of the homogeneous toichiometric garnet structure. D.M.Edwards

534.23 : 538.6

759. RESONANT ABSORPTION OF SOUND IN METALS. I.S.Steinberg. hys. Rev., Vol. 110, No. 6, 1467-9 (June 15, 1958).

Investigates theoretically the variation of ultrasonic attenuation ith strength of applied magnetic field. A derivation is given of the esonance rules inferred by Morse, Bohm and Gavenda from their xperiments on copper (Abstr. 5466/1958). The conditions for maxnum and minimum attenuation are just the reverse of those given y Pippard (Abstr. 9769/1957). D.M.Edwards

534.231

760. INTRODUCTION TO THE CALCULATION OF SOUND HENOMENA. (SOUND FIELDS OF RADIATORS, PISTON IAPHRAGMS, SPHERES, ETC). [Leitfaden zur Berechnung von chellvorgängen (Schallfelder von Strahlern, Kolbenmembran, ugeln u.s.w.)] H.Stenzel. econd revised edition by O.Brösze, Berlin: Springer Verlag (1958) 37 pp. In German.

Brösze points out that a description of sound phenomena is not ompleted solely by a statement of mathematical formulae, but requires in addition graphical illustrations and the working out of examples. The purpose of the second edition has been to include an xtensive survey of the sound fields of piston-diaphragms and pherical sound-transmitters. The book is mainly theoretical and ontains numerous diagrams illustrating the pressure amplitude and hase distributions in the sound-fields around various sound sources nd obstacles. It contains also a number of useful mathematical bles and a list of references. A.B.Wood

534.231 : 621.395.62

761. AN INVESTIGATION OF AN ELECTRON–ACOUSTIC ONVERTER. Yu.B.Semennikov. kust. Zh., Vol. 4, No. 1, 73-84 (1958). In Russian.

The paper describes a number of methods of rendering an coustic field visible. The derivation is given of basic relationships for etermining the output signal of an electron–acoustic converter and s variation with magnitude of the input acoustic pressure with iven contrast. This converter has a piezoelectric plate on which ound is focused producing an e.m.f. distribution on the plate which epresents the acoustic image. The plate is scanned by an electron eam and the secondary emission from the plate forms an electron nage which is displayed on a c.r. tube. C.R.S.Manders

534.231

762. PULSE SPECTRUM AT THE FOCUS OF A LENS. .A.Blyakhman. kust. Zh., Vol. 4, No. 2, 128-30 (1958). In Russian.

Theoretical. Considers the field at the focus and its pulse pectrum caused by the motion of a medium containing random nhomogeneities. It is shown that the lens acts as a filter changing ne energy distribution with respect to frequency. C.R.S.Manders

534.232 : 621.395.62

763. THE THEORY OF PIEZO-TRANSDUCERS. .V.Goncharov. kust. Zh., Vol. 4, No. 1, 37-46 (1958). In Russian.

Certain relationships are derived connecting the sensitivity of hese transducers with their electrical impedance. Frequency haracteristics are given for X-cut piezo-plates, steel, Al, fused uartz and Mg. The effect of an adhering layer is considered in erms of its thickness and acoustic properties. C.R.S.Manders

534.232

764. THE EFFECT OF THE FINITENESS OF THE AMPLITUDE OF A SOUND SOURCE ON THE [ACOUSTIC] WAVEFORM. .A.Senkevich. Akust. Zh., Vol. 4, No. 1, 102-3 (1958). In Russian.

The author shows that, for waves of finite amplitude, apart from dispersion and distortions due to non-linearity of the hydrodynamic equations and of the equation of state, it is necessary to take into account the effect of finiteness of the amplitude of the source when the latter emits higher harmonics. S.Chomet

534.232

6765. DESIGN AND ABSOLUTE CALIBRATION OF A MAGNETO-ELECTRIC ACOUSTIC RADIATOR. V.P.Zaĭtsev, G.P.Motulevich and I.L.Fabelinskiĭ. Akust. Zh., Vol. 4, No. 2, 137-42 (1958). In Russian.

This is an extension of earlier work (Abstr. 340/1957). There is a full description of the apparatus, for which errors not greater than 1-2% are claimed. C.R.S.Manders

534.232

6766. THE EFFECT, ON A RECEIVING SYSTEM, OF AGGREGATE INDEPENDENT NOISE SOURCES SITUATED ON THE SURFACE OF A SPHERE OF FINITE RADIUS. V.I.Klyachkin. Akust. Zh., Vol. 4, No. 2, 153-60 (1958). In Russian.

The concepts of a concentration coefficient and a directivity characteristic of a receiver system for the near field of independent sound sources situated on a certain surface. The particular case is developed for point sources of sound arranged on the surface of a radiating sphere, and concentration coefficients of receiver systems of various types are worked out. C.R.S.Manders

534.232

6767. NEW RESEARCHES ON THE ULTRASONIC FREQUENCIES PRODUCED BY AIR JETS. M.Merle. Ann. Télécomm., Vol. 12, No. 12, 424-6 (Dec., 1957). In French.

The frequency of the discrete sound radiated from the shock-wave region in choked air-jets was studied as a function of air pressure and of orifice cross-sectional shape. A continuous function is reported for a two dimensional orifice and discontinuous functions for circular and square orifices. These relations are correlated with changes in the periodic structure of the jet stream. H.D.Parbrook

534.232 : 621.395.623.7

6768. ELECTROACOUSTICS AND TRANSDUCERS. F.V.Hunt. J. Acoust. Soc. Amer., Vol. 30, No. 5, 375-7 (May, 1958).

Paper read at the Acoustical Society of America symposium on "Unsolved problems in acoustics", October 1957, referring to: (a) the limitations in transducers in efficiency, frequency range, and in the mismatch between them and the medium; (b) the inadequate theories of vibrating membranes and plates and for large amplitude oscillations; and (c) the design of an effective loudspeaker. H.D.Parbrook

534.232 : 532.528

6769. SONIC ENGINEERING. T.F.Heuter. J. Acoust. Soc. Amer., Vol. 30, No. 5, 378-80 (May, 1958).

Paper read at the Acoustical Society of America symposium on "Unsolved problems in acoustics", October 1957, referring to the inadequacy of available transducers and to the lack of knowledge on acoustically induced cavitation. H.D.Parbrook

534.232 : 534.321.9

6770. ELECTROSTRICTIVE GENERATION OF ULTRASOUND IN LIQUIDS. E.Gerdes. Naturwissenschaften, Vol. 45, No. 12, 280-1 (1958). In German.

Investigations have hitherto disregarded the influence of the deformation of the electrodes by Coulomb attraction. In earlier work only discrete frequencies 3.5 and 5 Mc/s were employed. The author points out the possibility of resonances in the electrodes and intervening liquid and the necessity to use a continuously variable range of frequency. The author employs a frequency range of 400 kc/s to 1.3 Mc/s. With circular steel electrodes 50 mm thick six resonances were observed agreeing within 0.5% of the calculated values. With nitrobenzol, for E_0 = 5 kV/cm and E_1 = 1 kV/cm the author observed Δp_m = 33.3 dyn/cm, where Δp_m is the alternating sound pressure amplitude. This is not greater than the Coulomb attraction effect. A.B.Wood

534.232 : 539.2

6771. PARAMAGNETIC CENTERS AS DETECTORS OF ULTRASONIC RADIATION AT MICROWAVE FREQUENCIES. C.Kittel. Phys. Rev. Letters, Vol. 1, No. 1, 5-6 (July 1, 1958).

There are a number of suitable transducers that should produce microwave phonons, and it is suggested that these phonons could be detected by the change in saturation of an electron-spin resonance-line that they cause. The detector would be operated near saturation

of the line in a paramagnetic salt with the external magnetic field adjusted so that paramagnetic resonance occurs at the phonon frequency. An approximate calculation shows that a sensitivity of 10^{-4} $\mu W/cm^2$ of phonon energy flux is possible. D.Walsh

534.24

6772. FOCUSING OF SOUND ON REFLECTION FROM THE BOUNDARY OF AN INHOMOGENEOUS MEDIUM.
A.N.Barkhatov and I.I.Shmelev.
Akust. Zh., Vol. 4, No. 1, 100-1 (1958). In Russian.

The authors report an experimental verification of Brekhovskikh's (Abstr. 8044/1956) equation for a caustic curve formed on reflection of sound from a boundary of an inhomogeneous medium. A medium with the required properties was produced by interdiffusion of a salt solution and water in a bath. The experiments were carried out at 2.7 Mc/s. The acoustic field in the reflected wave was measured by means of an acoustic probe. The agreement between Brekhovskikh's theory and this experiment was found to be fairly satisfactory. S.Chomet

534.26

6773. DIFFRACTION OF SOUND ON AN INFINITE, THIN, ELASTIC CYLINDRICAL SHELL. L.M.Lyamshev.
Akust. Zh., Vol. 4, No. 2, 161-7 (1958). In Russian.

Using an integro-differential equation method the author studies scattering of sound on a cylindrical shell. It is established that oscillations of the shell can lead to a considerable change of the polar scattering characteristics and of the magnitude of the scattered power, as compared with that exhibited by a rigid, fixed cylinder similar in dimensions to the shell. C.R.S.Manders

534.26

6774. SCATTERING OF SOUND WAVES ON A LIQUID DROP.
M.Moshinsky.
An. Inst. Fís., Vol. 1, 55-68 (1955). In Spanish.

The present paper deals with the scattering of sound waves in a gas, by liquid drops or soap bubbles. The main interest of this analysis lies in the insight it gives on the problem of scattering of nucleons by collective motions according to the model of A.Bohr. The equations and boundary conditions that characterize the scattering are discussed, both for the case of a liquid drop and for the case of a soap bubble. For a liquid drop, the function relating the sound wave potential and its normal derivative, at the surface of the drop, has just one resonance for each spherical harmonic, and its behaviour as a function of frequency and l is discussed. The case of the soap bubble would be a more realistic approach to nuclear case, one would have the natural frequencies of vibration of the air inside the soap bubble and of the soap bubble itself. The effect of the soap bubble on the position of the resonances and their widths (defined in a way similar to the nuclear scattering problem), is discussed in detail. A.

534.321.9

6775. SIMPLE DEMONSTRATION OF THE PRESENCE OF SECOND HARMONIC IN PROGRESSIVE ULTRASONIC WAVES OF FINITE AMPLITUDE. K.L.Zankel and E.A.Hiedemann.
J. Acoust. Soc. Amer., Vol. 30, No. 6, 582-3 (June, 1958).

This method makes use of the diffraction of light by ultrasonic waves (3 Mc/s) in a liquid (carbon tetrachloride), and of a plate (1 mm thick stainless steel) set at an angle to the sound as a transmission plate to separate first and second harmonics. A photomultiplier circuit permits quantitative detection of small amounts of distortion. H.D.Parbrook

534.39 : 534.23

6776. ON THE CONNECTION OF ACOUSTIC STREAMING WITH ABSORPTION OF SOUND. A.I.Ivanovskiĭ.
Akust. Zh., Vol. 4, No. 2, 143-52 (1958). In Russian.

A theoretical paper examining the hydrodynamics of the problem and putting forward a method of deriving the equations for a "Stokes–Navier" medium. The equations obtained show that the occurrence of streaming is associated with the total absorption coefficient and the frequency dependence of streaming velocity is completely determined by the frequency variation of this coefficient. C.R.S.Manders

534.41

6777. THEORY AND PRACTICE OF THE ANALYSIS OF THE VIBRATIONS IN THE TRANSITION REGION. L.Pimonow.
Ann. Télécomm., Vol. 13, No. 3-4, 100-11 (March-April, 1958). In French.

The author identifies the transition phenomena with a perturbation or a non-permanent equalization of energy which presents a mixture of vibrations of which the frequencies, phases and amplitudes vary with time. The author proposes a quantitative definition for the notion "transition acoustic vibration" founded on the time constant of response of the ear. The influence of the measuring apparatus on the structure of the sound spectrum is discussed, and a standard analyser based on the physical characteristics of the ear is proposed. Typical spectra recorded by this analyser are shown. A.B.Wood

534.41

6778. THEORY AND PRACTICE OF THE ANALYSIS OF VIBRATIONS IN THE TRANSITION REGION. L.Pimonow.
Ann. Télécomm., Vol. 13, No. 5-6, 125-52 (May-June, 1958). In French.

This forms the second and third parts of an earlier paper (see preceding abstract). Reproduction of the mechanism of hearing is difficult because of the following characteristics of the ear: (1) a low level of distortion; compared with the non-linearity of perception of intensities, (2) the effect of masking and (3) the rapid damping of selective systems of the ear, compared with its very great power of discrimination. A scheme of "logarithmic" sensitivity in a spectrometer is proposed, conforming to the mechanism of audition. Oscillograph records are reproduced showing the response of filters to transients. Construction of the apparatus used in the analysis of acoustic vibrations in the transition region is given. Numerous records are reproduced illustrating the analysis of various types of vibration in the transition region. A.B.Wood

534.414

6779. INVESTIGATION OF WATER–AIR RESONATORS.
V.I.Sorokin.
Akust. Zh., Vol. 4, No. 2, 187-95 (1958). In Russian.

A vessel filled with air and plunged mouth downwards in water can function as a Helmholtz resonator, the characteristic frequency and radiation resistance of the arrangement being calculable by the usual standard methods. With large sound fields in the liquid there is an enhanced energy-loss not explainable by the normal loss mechanisms. The loss, however, is accounted for by droplet fountain formation at the water–air separation in the throat of the vessel. The author makes an estimate of this new type of loss by introducing a friction-force depending on (velocity)^3. C.R.S.Manders

534.61 : 621.395.61

6780. RESEARCHES ON PROBE MICROPHONES.
I.Barducci and U.Degano.
Ann. Télécomm. Vol. 12, No. 12, 436-42 (Dec., 1957). In French.

An improved form of probe tube microphone is described in which the probe is terminated by a small tube, and the size of the air coupler to the microphone is less critical than in other designs. H.D.Parbrook

534.61 : 541.15

6781. HAEMOLYSIS AS INDICATOR FOR CROSSED ULTRASONIC FIELDS. T.Tarnóczy.
Z. angew. Phys., Vol. 9, No. 6, 275-8 (June, 1957). In German.

Discusses the state of particle vibration in the sound field which results from two ultrasonic fields crossing at right angles. Schematic structure diagrams are shown which indicate the amplitude direction of vibration, and state of polarization for both travelling and stationary wave fields crossing at right angles. The case of crossed stationary wave fields in which one is shifted $\pi/2$ in phase is also illustrated. Curves are shown which give percentage haemolysis as a function of time for (a) crossed fields and (b) linear fields. The physical, mechanical and chemical effects of ultrasonic vibrations on red blood corpuscles are discussed. The application of these characteristics to the use of haemolysis as as indicator of the vibration structure of ultrasonic wave fields (in particular, crossed stationary-wave fields) is described. A.B.Wood

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also under "Medical science. Human physiology". Decimal classification 612.85

534.782

6782. SPEECH AND COMMUNICATION. G.A.Miller.
J. Acoust. Soc. Amer., Vol. 30, No. 5, 397-8 (May, 1958).

Paper read at the Acoustical Society of America symposium on "Unsolved problems in acoustics", October 1957, referring to the problems surrounding the possible construction of a machine capable of translation from printed to spoken word and vice versa. H.D.Parbrook

534.784

6783. UNRELEASED VELAR PLOSIVES AFTER BACK-ROUNDED VOWELS. P.Delattre.

. Acoust. Soc. Amer., Vol. 30, No. 6, 581-2 (June, 1958).
Comments on two recent articles (Abstr. 4099/1957 and
.W.Householder, Jr. Unreleased PTK in American English.
'or Roman Jakobson (Mouton, The Hague, 1956), pp. 235-244),
mphasizing the different behaviour of velars after spread and
ounded vowels, and that final velars suffer considerably more than
nal dentals or labials from the elimination of the release. Also
uggests that both papers show misinterpretation of the cue value
esiding in formant transitions. H.D.Parbrook

534.83

784. NOISE, SHOCK, AND VIBRATION. R.O.Fehr.
. Acoust. Soc. Amer., Vol. 30, No. 5, 385-6 (May, 1958).
Paper read at the Acoustical Society of America symposium on
Unsolved problems in acoustics", October 1957, referring to the
roblems of (a) analysing and controlling impact noise, the reaction
f engineering structures to shock, and vibration noise in machinery;
b) measuring the total sound power in an acoustic field to permit
neaningful noise specifications; and (c) measuring damage under
hock. H.D.Parbrook

534.843

785. FREQUENCY AND DIRECTIONAL DISTRIBUTION OF
NORMAL OSCILLATION MODES IN A REACTANGULAR ROOM.
da Da-Yu.
kust. Zh., Vol. 4, No. 2, 168-73 (1958). In Russian.
As the dimensions of the enclosed space are increased and as
he sound frequencies rise, it is found that the angular distribution
f the oscillation modes approaches a random distribution.
C.R.S.Manders

OPTICS. RADIATION. SPECTRA

535.13

786. APPLICATION OF [THE THEORY OF] DISTRIBUTIONS TO
'HE MAXWELL AND HELMHOLTZ EQUATIONS. M.Bouix.
:.R. Acad. Sci. (Paris), Vol. 246, No. 20, 2858-60 (May 19, 1958).
n French.
Equations for a monochromatic wave are written in the form

$$\{\mathrm{curl}\,\vec{H}\} + \vec{n}\times\Delta(\vec{H})\,\delta_S - i\omega\varepsilon\,\vec{E} = \vec{J},$$

with a similar equation involving curl $\vec{E}$; $\Delta(\vec{H})$ is here the discontinuity in H at a surface S, and $\{f\}$ denotes the value of a distribution f at any point where it is a continuous function. R.A.Newing

535.135 : 535.32

787. TIME REVERSAL SYMMETRY AND ELECTROMAGNETIC
POLARIZATION FIELDS. R.A.Satten.
. chem. Phys., Vol. 28, No. 4, 742-3 (April, 1958).
In the expansions given in Abstr. 5155 (1957) of the electric and
nagnetic dipole and electric quadrupole moments per unit volume
nduced by an electromagnetic wave travelling through a crystal,
certain terms can be shown by time-reversal considerations to
ppear only in the presence of an external magnetic field. One
pplication of this is to determine which terms contribute to natural,
nd which to induced, circular double refraction. J.Hawgood

535.23.08 : 537.312.5

HIGH-SENSITIVITY CRYSTAL INFRARED DETECTORS.
ee Abstr. 5916

535.247.4 : 537.312.5

788. THE USE OF GaAs PHOTOCELLS IN DENSITOMETRY.
E.Golling.
Z. angew. Phys., Vol. 9, No. 5, 255-9 (May, 1957). In German.
It is shown that these cells are perfectly satisfactory for use
in microphotometers, and that their wavelength characteristics
match well with a tungsten lamp. Among the points discussed are
he behaviour of microscope objectives in the near i.r., the variation
with wavelength of the photographic density, and a comparison with
a Se photocell. J.M.Hough

535.315

789. A NOTE ON RANGE-FINDER PRISM-CORRECTORS.
C.Morais.
Atti Fond. Ronchi, Vol. 13, No. 1, 59-70 (Jan.-Feb., 1958).
In Italian.
The double-prism corrector has residual deviations due to
differences of angle of incidence on the two prisms. The passage of
rays through the prisms is considered by vector methods and the
errors are calculated. R.W.Fish

535.317.1

790. FORMATION OF AXICON IMAGES. J.L.Rayces.
J. Opt. Soc. Amer., Vol. 48, No. 8, 576-8 (Aug., 1958).
For an axicon the wavefront in the image space from an axial object point has two caustic surfaces, one greatly distant from the axis and the other degenerate and coinciding with the axis. Axicon imagery is explained in terms of this phenomenon.
W.T.Welford

535.317.1

791. ASYMPTOTIC BEHAVIOUR OF THE RESPONSE FUNCTION OF OPTICAL SYSTEMS. I.Ogura.
J. Opt. Soc. Amer., Vol. 48, No. 8, 579-80 (Aug., 1958).
An asymptotic expansion of the integral over the pupil in descending powers of the aberration coefficients. The leading terms for astigmatism, coma and spherical aberration are given, but no numerical results. W.T.Welford

535.317.3

792. NOTE ON THIN-LENS COLOR CORRECTION FOR VARIABLE FOCAL-LENGTH LENSES. M.Reiss.
J. Opt. Soc. Amer., Vol. 48, No. 8, 578-9 (Aug., 1958).
Least-squares method of obtaining ν-values for the components which satisfy tolerance conditions over the zooming range.
W.T.Welford

535.317.6

793. MARK SENSING IN OPTICAL COMPUTATIONS.
D.A.Pontarelli, R.B.Wise and O.H.Olson.
J. Opt. Soc. Amer., Vol. 48, No. 7, 502-3 (July, 1958).
Mark sensing involves machine recognition of electrographic pencil marks representing numerical values. Although widely used in accounting and banking, it has not been used much for numerical data presentation to computors used for optical work. Ray-tracing and colour calculations both require short computor running times and are well suited to the mark-sensing technique. Typical card layouts are shown. R.W.Fish

535.323 : 535.343

794. THE OPTICAL PROPERTIES OF ANTIMONY TRISULPHIDE FILMS. C.Kunze.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 165-72 (1958).
In German.
The absorption constant and refractive index were determined over the range from 400 to 1000 mμ from transmission and reflection measurements. The absorption edge at 600 mμ was found to correspond to an energy band level of 2 eV. The similarity in crystal structure between antimony trisulphide and selenium suggests that the amorphous films obtained by evaporation might have a similar structure to amorphous selenium. Electron diffraction photographs confirm this. R.W.Fish

535.323

795. INDEX OF REFRACTION OF GERMANIUM.
C.D.Salzberg and J.J.Villa.
J. Opt. Soc. Amer., Vol. 48, No. 8, 579 (Aug., 1958).
A table is given for the index of refraction (27^0 C) of polycrystalline and of single crystal germanium in the wavelength range from 2 to 16 μ. Within the estimated accuracy of $\pm 3\times10^{-4}$ there is no difference between the two sets of values. B.T.M.Willis

535.329 : 534.2

ELECTRICAL POLARIZATION OF ELASTIC WAVES IN CRYSTALS AND OPTICAL DISPERSION. See Abstr. 6733

535.33.03 : 537.525.8

INFRARED EMISSION FROM HIGH-FREQUENCY DISCHARGES IN CO_2. See Abstr. 5942

535.33.07

796. THE EFFECT OF SCATTERED LIGHT IN A MONOCHROMATOR DURING ABSOLUTE MEASUREMENTS USING A STANDARD SOURCE. G.F.Sitnik.
Astron. Zh., Vol. 35, No. 1, 137-42 (1958). In Russian.
In the course of absolute photometry of the continuous solar spectrum (by comparison with a standard lamp) it became necessary to investigate the effect of scattered light in the monochromator employed in these measurements. The results of this investigation are now reported. It is shown that the effect of scattered light in the range 3700-6000 A is roughly the same in the case of the sun and of the standard lamp. It is concluded that it is unnecessary to correct for the scattered light. S.Chomet

535.33.07

797. DISPERSION OF A DOUBLE-PASS SPECTROGRAPH.
T.A.Wiggins and G.D.Saksena.

J. Opt. Soc. Amer., Vol. 48, No. 6, 429-30 (June, 1958).

It is shown that the dispersion of a double-pass plane-grating instrument is twice that of a single-pass only when the angles of incidence and diffraction are equal. And this condition should be approximated as closely as possible to obtain the highest intensity when working away from the blaze. G.F.Lothian

535.33.07

6798. GRATING VACUUM MONOCHROMATOR FOR THE SPECTRAL RANGE 1000-6500 A.
J.M.Sluyters and E.de Haas.
Rev. sci. Instrum., Vol. 29, No. 7, 597-600 (July, 1958).

The instrument was built in order to get information about the excitation processes in a discharge tube. Using a Paschen–Runge mounting the spectrum was detected with a cooled E.M.I. photomultiplier, which can move along the Rowland circle with a velocity of 0.1-12 A/sec. At the wavelength of 2500 A, 0.6 A could be resolved. A.

535.33.07

6799. DOUBLE BEAM INFRARED SPECTROPHOTOMETER USING DOUBLE PASS, TRIPLE PASS, DOUBLE MONOCHROMATOR AND DOUBLE PASS DOUBLE MONOCHROMATOR.
K Kudo.
Sci. of Light (Tokyo), Vol. 5, No. 3, 89-109 (Dec., 1956).

A spectrophotometer using Lochester and Martin's method and an instrument using Walsh's method have been constructed. The increase of resolution, the scanning speed and the effect of false radiation are examined and discussed. These spectrophotometers have higher resolution and faster scanning speed than a common single pass instrument. But as far as the effect of false radiation is concerned, the multiple pass spectrophotometer using a double monochromator exceeds that using Lochester and Martin's method. A.

535.33.07

6800. REMARKS ON "A LIGHT MODULATOR FOR USE WITH AN INFRARED DETECTOR", BY R.KESSLER. H.Frenk.
Z. angew. Phys., Vol. 9, No. 5, 259-60 (May, 1957). In German.

A discussion of the theory of the modulator of Kessler (Abstr. 8087/1956). G.F.Lothian

535.331 : 537.228.5

6801. RESEARCHES UPON THE STARK EFFECT OF THE ATOM OF MERCURY BY THE MAGNETIC RESONANCE METHOD.
J.E.Blamont.
Ann. Phys. (Paris), Sér. 13, Vol. 2, No. 7-8, 551-610 (July-Aug., 1957). In French.

Extensive experimental studies were made by the magnetic resonance method upon the Stark effect (10-70 kV/cm) in the 6^3P_1 level of the isotopes of mercury. Measurements were also made of the dependence of the lifetime of the state upon pressure. Extrapolation to zero pressure leads to a "true" lifetime of 1.19×10^{-7} sec. Profiles of magnetic resonance lines were also studied. All of the results are in excellent accord with theory. R.W.Nicholls

535.331

6802. HYPERFINE STRUCTURE AND IDENTIFICATION OF SOME PRASEODYMIUM LINES. V.B.Belyanin.
Optika i Spektrosk., Vol. 4, No. 2, 264-6 (1958). In Russian.

The spectrum from a hollow cathode discharge was examined on a Fabry–Perot interferometer crossed with a grating. Details of the splitting of four Pr II and ten Pr I lines are given and the assignment of ten Pr II lines discussed. L.Bovey

535.331

6803. SPECTRA OF MoII, MoIII, MoIV AND MoV BETWEEN 680 AND 2000 A. F.R.Rico.
An. Real Soc. Españ. Fís. Quím., Vol. 53(A), No. 9-10, 185-200 (Sept.-Oct., 1957). In Spanish.

The high-voltage spark spectra of molybdenum were investigated for the purpose of compiling a comprehensive line-list for forthcoming term analyses of these spectra. It was possible to differentiate clearly the lines belonging to MoII, MoIII, MoIV and MoV by the shape of the lines. Wavelengths and intensities are presented for 809 lines in the spectra MoII, 211 in MoIII, 675 in MoIV and 47 in MoV, in the wavelength range 680-2000 A. 33 lines of MoIV given by Eliason (1933) and 34 lines of MoV given by Trawick (1934) were now re-measured. A.

535.331

6804. ON THE HYPERFINE STRUCTURE OF THE 5461 A LINE OF MERCURY. J.Blaise and H.Chantrel.
C.R. Acad. Sci. (Paris), Vol. 246, No. 8, 1185-7 (Feb. 24, 1958). In French.

The apparent disagreement between the recent measurements of Agarbiceanu, Ionescu-Pallas and Draganescu (Abstr. 109/1958) and previous authors is shown to be due to inconsistent choice of origin of the hyperfine structure. Using the correct origin, the disagreement is removed and it is suggested that the results of Agarbiceanu et al. are somewhat in error as a result of their using a mercury source of too high a temperature, which resulted in inadequate resolutions. R.W.Nicholls

535.332 : 539.18

6805. THE SPECTRUM OF THE SINGLY-IONIZED NITROGEN ATOM. K.B.S.Eriksson.
Ark. Fys., Vol. 13, Paper 25, 303-29 (1958).

The spectrum of ionized nitrogen was studied in the region 10 547-2077 A by using a spark-generated high-frequency electrodeless discharge and stigmatic concave-grating spectrographs. About 450 spectrum lines, experimentally classified as N II, were measured. In the vacuum region improved wavelengths for 15 spectrum lines between 1743 A and 1084 A were obtained from some old plates. Analysis of the new data has given 55 new levels and approximately 200 newly-classified spectrum lines, including the resonance lines, $2s^22p^2\,^3P_{2,1}$-$2s2p^3\,^3S_1$, at 2142.775 A and 2139.007 A. A consistent system of term values has been derived, and accurate wavelengths in the vacuum region have been recalculated from the term system. The ionization limit has been determined from selected nf series with the result: $2s^22p^2P_{1/2} = (238\,750.5 \pm 1.3)\text{cm}^{-1}$. A.

535.332

6806. STANDARD WAVELENGTHS IN THE VISIBLE SPECTRA OF KRYPTON-86 AND MERCURY-198. J.Terrien.
C.R. Acad. Sci. (Paris), Vol. 246, No. 16, 2362-4 (April 21, 1958) In French.

Measurements of λ5650 A in the krypton spectrum and of $\lambda\lambda$5791, 5770, 5461 and 4358 A in the mercury spectrum by comparison with the standard λ6056 A in the krypton spectrum. The uncertainties are less than 1 in 10^8. A.H.Cook

535.333 : 535.343 : 535.37

6807. GENERAL RELATIONSHIPS BETWEEN ABSORPTION AND EMISSION FOR THE MODULATION SPECTRA OF POLYATOMIC MOLECULES. B.S.Neporent.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 4, 682-5 (1958). In Russian.

It is assumed that the problem of these relationships for polyatomic molecules of all types should be attacked in the same way as for a narrow-level system: by analysing the equilibrium of molecules with the equilibrium emission, the characteristics of the individual molecules thus obtained being used for the analysis of luminescence excited in stationary conditions. Various relationships are developed by the author for molecules characterized by modulation spectra, i.e. molecules in which electron states can be considered to be independent of vibration states. One of the relationships developed is similar to that obtained by Stepanov (Abstr. 8517/1957) from less general considerations. From another relationship obtained by the author it follows that, in addition to the known need for expressing the intensity of the absorption and emission spectra in comparable units, it is also necessary to standardize spectral curves by making areas under them equal. Given suitable methods of standardization and presentation, the spectral curves of absorption and emission intersect always at $\nu = \nu_0$. The relationships do not apply to extinction spectra. F.Lachman

535.333

6808. ABSOLUTE VALUES OF THE FORCES OF THE OSCILLATORS OF RESONANCE LINES FOR Mg I, Ca I, Sr I AND Ba I.
Yu.I.Ostrovskii, N.P.Penkin and L.N.Shabanova.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 1, 66-8 (1958). In Russian.

The authors developed a new method of determining the f-numbers, based on the simultaneous measurement of total absorption and dispersion. A formula developed for the coefficient of extinction (γ) includes these two magnitudes. When both the large-density emission and the extinguishing collisions are absent, γ determines the oscillator force f_{ik}. The f-number of the 1nI line ($^1P_{1/2}$-$^1S_{1/2}$), as determined by this method, agrees well with the value found by the method of "hooks". The f-number of the resonance lines ($^1p_1$-$^1s_0$) of Mg I, Ca I, Sr I and Ba I were determined, using an experimental setup partly described in a previous paper (Abstr. 4865/1958). The values obtained, ranging from 1.2 to 1.7 (±0.2 or 0.3), are tabulated; the f-numbers of the alkaline earth elements increase with their atomic number. F.Lachman

535.333

6809. LEWIS–RAYLEIGH NITROGEN AFTERGLOW.
G.B.Kistiakowsky and P.Warneck.
J. chem. Phys., Vol. 27, No. 6, 1417-18 (Dec., 1957).

Relative populations of vibrational levels in $B\ ^3\Pi_g$ are derived from intensities in the afterglow of N_2^{14} and N_2^{15}. A maximum is found at about 19 000 cm^{-1}, coinciding with the energy of the $^6\Sigma_g^+$ state. This proves the mechanism, applying to the higher v'- levels,

$$N + N + M \rightleftharpoons N_2\ (^6\Sigma_g^+) + M$$

$$N_2\ (^6\Sigma_g^+) + M \rightarrow N_2\ (^3\Pi_g) + M.$$

Bands of a new system have been observed at 6900 and 10 600 A (see abstract following). R.F.Barrow

535.333

6810. NEW BAND SYSTEM IN THE AFTERGLOW OF NITROGEN.
F.LeBlanc, Y.Tanaka and A.Jursa.
J. chem. Phys., Vol. 28, No. 5, 979-81 (May, 1958).

Seventeen bands ($\lambda\lambda$ 6000–9000 A, $v' = n - n + 4$; $v'' = 0 - 4$) of a new N_2 system whose ground state is $B^3\Pi_g$ are reported with a partial vibrational analysis. Each band has three prominent heads and some show a fourth head. The system is produced most strongly in a 5%–10% N_2–90%–95% A afterglow. Cooling of the afterglow tube with liquid N_2 suppresses the N_2 first-positive bands which lie in the same region. A tentative suggestion is made that a theoretically predicted $^3\Delta_u$ state is the upper state of the transition, which would make n = 5. R.W.Nicholls

535.333

6811. RECOMBINATION OF ATOMIC OXYGEN OBSERVED BY MEANS OF THE FLASH SPECTROSCOPY OF MOLECULAR OXYGEN IN THE VACUUM ULTRAVIOLET.
J.A.Golden and A.Myerson.
J. chem. Phys., Vol. 28, No. 5, 978-9 (May, 1958).

Preliminary time-delayed absorption spectra in the Schumann–Runge region through an atmosphere of recombining O atoms are discussed. Absorption from $v'' = 1$ as well as 0 of the $X^3\Sigma_g^-$ ground state of O_2 indicates recombination into vibrationally excited levels. R.W.Nicholls

535.333 : 535.343

6812. THE EFFECT OF A SOLVENT ON THE ABSORPTION AND EMISSION SPECTRA OF AN IMPURITY. A.F.Lubchenko.
Ukrayin. fiz. Zh., Vol. 1, No. 2, 120-33 (1956). In Ukrainian, with summary ($\frac{1}{2}$ p.) in Russian.

An attempt to apply quantum electrodynamics to the problems of absorption and emission spectra of solutions. Arising out of the expressions derived for the probability of absorption and emission of light by an impurity centre, a connection is established between the Einstein differential coefficients and the case where the frequencies of emitted and absorbed light differ from one another. C.R.S.Manders

535.333

6813. EXTENSION OF THE SCHUMANN–RUNGE BAND-SYSTEM OF THE OXYGEN MOLECULE INTO THE NEAR ULTRAVIOLET IN ABSORPTION AND IN EMISSION.
D Rakotoarijimy, S.Weniger and H.Grenat.
C.R Acad. Sci. (Paris), Vol. 246, No. 20, 2883-6 (May 19, 1958). In French.

The system was studied in emission and in absorption using a high-frequency discharge through O_2 at atmospheric pressure. Eight new bands were identified in absorption between 1980 and 2270 A and 28 new bands were identified in emission betweeen 2100 and 3800 A. R.W.Nicholls

535.333

6814. ABSOLUTE EMISSION INTENSITY OF SCHUMANN–RUNGE RADIATION FROM SHOCK HEATED OXYGEN.
J.Keck, J.Camm and B.Kivel.
J. chem. Phys., Vol. 28, No. 4, 723-4 (April, 1958).

Absolute measurements of intensity at two bands 33 A wide and 66 A apart appear to support the expectation (Abstr. 1599/1958) that the spectral intensity varies as λ^{-3}. With this assumption an f value of 0.015 is obtained, this being much less than that obtained in absorption by Watanabe (Abstr. 1535/1953). A.G.Gaydon

535.333

6815. LINE SHAPE IN THE OH $^2\Pi - ^2\Sigma$ TRANSITION.
W.E.Kaskan.
J. chem. Phys., Vol. 28, No. 4, 729-30 (April, 1958).

Data of Oldenberg and Rieke are shown to be sufficient to calculate the width and shape of lines in the u.v. $^2\Pi - ^2\Sigma$ bands of OH. OH lines are very little broadened by H_2O and O_2 at atmospheric pressure and elevated temperatures. R.C.Seymour

535.333

6816. ULTRAVIOLET BANDS OF MERCURY CHLORIDE.
V.G.Krishnamurthy.
Z. Phys., Vol. 150, No. 3, 287-92 (1958).

Emission bands were photographed and wave-numbers in the range from 2400 to 2900 A tabulated. Assignments are discussed and vibrational constants calculated for the molecule HgCl. G.F.Lothian

535.333

6817. THE EMISSION SPECTRUM OF IODINE BROMIDE IN THE PRESENCE OF ARGON. I. THE BAND SYSTEM IN THE REGIONS 5425-5360 A, 4520-4415 A AND 4120-4010 A.
P.Venkateswarlu and R.D.Verma.
Proc. Indian Acad. Sci. A, Vol. 47, No. 3, 150-60 (March, 1958).

Four band-systems were excited in uncondensed transformer discharges through IBr in the presence of argon. Vibrational analyses are given for three of the systems which are new. It is suggested that the lower state of the first two of these systems is 0^+ at 16 814 cm^{-1} above ground. No further electronic assignments were made. R.W.Nicholls

535.333

6818. THE EMISSION SPECTRUM OF IBr EXCITED IN THE PRESENCE OF ARGON. II. THE BAND SYSTEM IN THE REGION 3915-3540 A. P.Venkateswarlu and R.D.Verma.
Proc. Indian Acad. Sci. A, Vol. 47, No. 3, 161-74 (March, 1958).

A vibrational analysis was made of 266 bands ($0 < v' < 31$; $0 < v'' < 27$) of the 3915-3540 A band system of IBr excited in an uncondensed transformer discharge through IBr in the presence of argon. Eye estimates of intensity show that the analysis is consistent with a well-marked primary Franck–Condon parabola, together with a number of fragmentary subsidiary parabolae. The possible electronic states of IBr are discussed and a $^3\pi(1)$ assignment for the lower state of the transition is made. R.W.Nicholls

535.333

6819. INFRARED CONTINUUM RADIATION FROM HIGH-TEMPERATURE AIR.
T.Wentink,Jr, W.Planet, P.Hammerling and B.Kivel.
J. appl. Phys., Vol. 29, No. 4, 742-3 (April, 1958).

High temperature air is obtained for about 30 μsec by reflecting plane shock waves in a shock tube. It shows a relatively high emission at λ = 1-2 μ, attributed to N_2 first positive bands, a smaller emission at λ = 2-4 μ ascribed to free–free transitions of electrons in the fields of atomic oxygen and nitrogen; and an increased emission at λ = 4-5 μ, not definitely accounted for, though perhaps to be attributed to bands of CO, NO, CN and OH. G.F.Lothian

535.333

6820. INFRARED EMISSION SPECTRA OF $B_2O_3(g)$ AND $B_2O_2(g)$.
D.White, P.N.Walsh and D.E.Mann.
J. chem. Phys., Vol. 28, No. 3, 508-9 (March, 1958).

The emission spectrum of B_2O_3 vapour containing B^{11} and B^{10} in natural abundance and of a sample containing 96% B^{10}, was examined in the infrared and isotope shifts observed. Comparison of the shifts with those predicted by the Teller–Redlich theorem make the D_{3h} model appear improbable. Of the several bent forms possible, the one with C_{2v} symmetry is considered the most acceptable. Similar observations on $B_2O_2(g)$ are reported. R.C.Seymour

535.337

6821. DETERMINATION OF THE HYPERFINE STRUCTURE AND ZEEMAN g_J-FACTORS OF THE ^2D GROUND STATE OF Y^{89} BY THE ATOMIC BEAM RESONANCE METHOD.
G.Fricke, H.Kopfermann and S.Penselin.
Naturwissenschaften, Vol. 45, No. 10, 237-8 (1958). In German.

535.337 : 537.311.33

6822. INFLUENCE OF AN ELECTRIC FIELD ON AN OPTICAL ABSORPTION EDGE. W.Franz.
Z. Naturforsch., Vol. 13a, No. 6, 484-9 (June, 1958). In German.

In an electric field of 10^5-10^6 V/cm the foot of the absorption edge is expected to broaden at the expense of the higher frequencies. The theory indicates that the exponential portion of the absorption edge is displaced to lower frequencies, and that this shift is proportional to the square of the field strength and to the mean reciprocal effective masses of a hole and an electron. B.T.M.Willis

535.338 : 537.562

6823. ON TYPICAL STATES IN THE SPECTRA OF DENSE PLASMAS. I. H.Bartels and R.Beuchelt.

Z. Phys., Vol. 149, No. 5, 594-607 (1957). In German.

Earlier work (Abstr. 4814, 6518/1950, 2717, 5240/1951, 4332/1954) is simplified and extended to spectral line density distributions in optically dense arc-columns. C.G.Morgan

535.338 : 537.562

6824. ON TYPICAL STATES IN THE SPECTRA OF DENSE PLASMAS. II. H.Bartels and R.Beuchelt.
Z. Phys., Vol. 149, No. 5, 608-23 (1957). In German.

The significance of spectral line density distribution measurements in high-pressure mercury arcs is examined on the basis of the theory given in Part I (see preceding abstract).

C.G.Morgan

535.338.334

6825. STUDY OF EMISSION AFTER (n – 1) TRANSFERS OF EXCITATION BETWEEN IDENTICAL ATOMS OR MOLECULES. Y.Héno.
C.R. Acad. Sci. (Paris), Vol. 246, No. 5, 716-19 (Feb. 3, 1958). In French.

The line-width after (n –1) transfers of excitation between identical atoms or molecules is shown to be $\gamma_0(\sqrt[n]{2} - 1)^{1/2}$, where γ_0 is the simple emission line-width. R.W.Nicholls

535.34.07

6826. INTEGRATION OF ABSORPTION BANDS. A.E.Martin.
Nature (London), Vol. 181, 1195 (April 26, 1958).

The area under an absorption band is proportional to the difference of the initial and final slopes of the function $\iint A\,d\nu\,d\nu$, where A is the absorption coefficient. Using two stages of conventional electrical integration, the band area is then the difference of the charging rates of a condenser before and after passing through the band. G.F.Lothian

535.34.07

6827. A SIMPLE TECHNIQUE FOR THE CALIBRATION OF THE WAVELENGTH SCALE OF SPECTROPHOTOMETERS. N.V.Parthasarathy and I.Sanghi.
Nature (London), Vol. 181, 44 (July 12, 1958).

The isobestic points of indicator absorption curves make convenient fixed wavelengths, provided that the indicators are pure. G.F.Lothian

535.34.07

6828. A LIQUID CUVETTE WITH CONTINUOUSLY VARIABLE LAYER THICKNESS FOR INFRA-RED SPECTROSCOPY. K.Steiner, B.Hampel and O.Bremer.
Z. InstrumKde, Vol. 66, No. 5, 101-2 (May, 1958). In German.

A detailed description and figure are given of a cell of 2.5 cm, aperture comprising rock salt plates which are adjustable for separation and parallelism by the distortion under pressure of thin ring-shaped parts of their supporting members. The cell uses 3.25 cm^3 of liquid, and the working thickness varies from zero to about 0.5 mm, which is determined to an accuracy of $\pm 1\,\mu$ by interference patterns produced by the empty cell.

S.T.Henderson

535.34.07

6829. APPARATUS FOR RECORDING SMALL CHANGES IN LIGHT TRANSMISSION IN TURBID SUSPENSIONS. L.Packer.
J. Opt. Soc. Amer., Vol. 48, No. 7, 503-4 (July, 1958).

Describes the substitution of an 1P21 photomultiplier in a Beckman Model DU for use with a pen recorder. G.F.Lothian

535.343 : 535.323

THE OPTICAL PROPERTIES OF ANTIMONY TRISULPHIDE FILMS. See Abstr. 6794

535.343

6830. INVESTIGATIONS ON THE VALIDITY OF BEER'S LAW FOR THE ABSORPTION OF RADIATION IN THE EXTREME ULTRAVIOLET IN O_2 AND N_2. H.Greiner.
Z. angew. Phys., Vol. No. 9, 434-7 (Sept., 1957). In German.

Beer's law is found valid for absorption in O_2 at four wavelengths in the Schumann continuum, and at 760 A. Deviations at 760 A for N_2 and at 835 A for O_2 and N_2 can be explained by insufficient resolution. A Lyman capillary discharge emitting a line spectrum is used. Experimental values of the absorption coefficient are within the range of values given by other authors.

C.Turner

535.343

6831. ABSORPTION COEFFICIENTS OF O_3 IN THE VACUUM ULTRAVIOLET REGION. M.Ogawa and G.R.Cook.
J. chem. Phys., Vol. 28, No. 1, 173-4 (Jan., 1958).

Preliminary measurements with a grating and photomultiplier coated with sodium salicylate. Continuous absorption commences near 950 A, which corresponds to the ionization potential; some weak bands overlap the continuum between 750 and 520 A.

G.F.Lothian

535.343

6832. ABSORPTION COEFFICIENTS OF C_6H_6 AND H_2 IN THE VACUUM ULTRAVIOLET.
S.M.Bunch, G.R.Cook, M.Ogawa and A.W.Ehler.
J. chem. Phys., Vol. 28, No. 4, 740-1 (April, 1958).

Measurements in the region from 1335 to 430 A show a complex absorption curve for C_6H_6, and H_2 shows continuous absorption at 800 A and shorter. G.F.Lothian

535.343

6833. ABSORPTION COEFFICIENTS OF METHYL, ETHYL, n-PROPYL AND n-BUTYL ALCOHOLS. M.Ogawa and G.R.Cook.
J. chem. Phys., Vol. 28, No. 4, 747-8 (April, 1958).

Measurements in the region from 1300 to 500 A show a broad band for vapours of all the alcohols, with a maximum near 800 A, and with increasing intensities for the higher homologues.

G.F.Lothian

535.343

6834. UNCERTAINTIES IN THE MEASUREMENT OF THE OSCILLATOR STRENGTH OF THE ULTRAVIOLET BANDS OF OH. P.J.Dyne.
J. chem. Phys., Vol. 28, No. 5, 999-1000 (May, 1958).

The absorption lines were found to be broader than expected, with a half-width of 0.86 cm^{-1} as compared with 0.56 cm^{-1} found by Oldenberg and Rieke (J. chem. Phys., Vol. 6, 439, 1938). Although the theoretical resolving power of the instrument was about 0.15 cm^{-1}, it appears that there was loss of resolution, and that the stronger lines were saturated. The lines appear to be almost purely Doppler broadened and show little pressure broadening (in O_2 and H_2O at 1 atm pressure). It is concluded that the line strengths have been consistently underestimated, and that the true f-values may well be appreciably greater than those obtained by Oldenberg and Rieke. R.F.Barrow

535.343

6835. HYDROXIDE ABSORPTION BAND IN ALKALI HALIDE CRYSTALS. J.Rolfe.
Phys. Rev. Letters, Vol. 1, No. 2, 56-8 (July 15, 1958).

Ultraviolet absorption measurements showed the presence of bands at the following wavelengths: 215.0 mμ (KBr), 203.5 mμ (KCl) and 190 mμ (NaCl). Reasons are given for believing that these bands are formed by hydroxide, an impurity (it is suggested) present in all crystals used in previous work on alkali halides. The absorption spectra of KBr and KCl irradiated at 78°K are described; irradiation appears to split the O—H bond, giving oxygen and hydrogen bands and the F—band. B.T.M.Willis

535.343

6836. FAR ULTRAVIOLET SPECTRA OF CHLOROCYCLOPROPANE. E.C.Eberlin and L.W.Pickett.
J. chem. Phys., Vol. 27, No. 6, 1439-40 (Dec., 1957).

The u.v. absorption spectra of chlorocyclopropane vapour shows an appreciable bathochromic shift with respect to cyclopropane, and this is interpreted as evidence for conjugation of the chlorine atom with the cyclopropane ring. G.L.W.Llewelyn

535.343

6837. MEASUREMENT OF THE ABSORPTION OSCILLATOR STRENGTH OF THE MAGNESIUM INTERCOMBINATION LINE AT 4571 A. G.Boldt.
Z. Phys., Vol. 150, No. 2, 205-14 (1958). In German.

The absorption line ($3^1S_0 - 3^3P_1$) was photographed with a xenon high-pressure source, a tube 50 cm long fitted with MgO windows and containing Mg vapour at temperatures in the range from 779° to 887°K, and a grating spectrograph. It is shown how to correct for the fact that the vapour may not be at equilibrium concentrations for the given temperatures. The value obtained, $f = 4.95 \times 10^{-6} \mp 20\%$, agrees well with a calculated value. G.F.Lothian

535.343 : 539.19

6838. PARAMAGNETISM OF HYDROCARBON–CONC. H_2SO_4 SYSTEMS. H.Kon and M.S.Blois, Jr.
J. chem. Phys., Vol. 28, No. 4, 743-4 (April, 1958).

The authors have observed the paramagnetic resonance and optical absorption spectra of several hydrocarbons dissolved in concentrated sulphuric acid. The optical absorption bands are very closely the same as those of the negative ions of the hydrocarbon used. This fact can be explained on a molecular orbital model, if one assumes that the paramagnetic species is a positive ion.

J.M.Baker

535.343

6839. SPECTRUM INVESTIGATION OF SIMPLER HYDROCARBON SOLUTIONS OVER A WIDE RANGE OF TEMPERATURES. M.T.Shpak.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 347-57 (1957). In Ukrainian.

The absorption spectra of diphenyl, dibenzyl, trans-stilbene, and toluene in pure 98-99% ethanol at 290°K, 77°K, and 20.4°K are recorded. Temperature change gives a frequency shift in the spectrum varying linearly with the oscillation intensity of electron transitions. With change from 290°K to 20.4°K the areas under the absorption curves remain unchanged. The results agree with those predicted theoretically. C.R.S.Manders

535.343

6840. A NEW ABSORPTION BAND IN DIAMOND AND ITS LIKELY CAUSE. F.A.Raal.
Proc. Phys. Soc., Vol. 71, Pt 5, 846-7 (May, 1958).

An absorption band at about 5500 A was observed in pink, mauve and in some brown diamonds. It is very broad at room temperature, and no structure can be resolved even at liquid oxygen temperatures. It is thought to be due to the foreign impurity Mn whose presence was established spectrochemically in three specimens in which the band was observed. The strength of the absorption band is correlated with the concentration of Mn. R.W.Nicholls

535.343

6841. THE NATURE OF THE FINE STRUCTURE IN THE OPTICAL SPECTRA OF CdS CRYSTALS.
V.L.Broude, V.V.Yeremenko and E.I.Rashba.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 96 (1957). In Ukrainian.

535.343

6842. LINE SPECTRUM OF THE EDGE OF FUNDAMENTAL ABSORPTION OF CADMIUM SULPHIDE CRYSTALS.
E.F.Gross, B.S.Razbirin and M.A.Yakobson.
Zh. tekh Fiz., Vol. 27, No. 5, 1149-51 (1957). In Russian.

CdS absorption spectra at 4.2°K are reported. A group of narrow weak lines at 4889-4860 A was observed at the intrinsic absorption edge. These lines vary in intensity, width and number visible from crystal to crystal. In one crystal various parts of it sometimes give different results so that the lines appear split, displaced or distorted. It is suggested that these lines are of excitonic or impurity origin. S.Chomet

535.343 : 537.312.5

ABSORPTION SPECTRUM OF CdS AT LOW TEMPERATURES.
See Abstr. 5913-14

535.343

6843. ON THE POLYMERIZATION OF ALKALI HALIDES.
P.Kusch.
J. chem. Phys., Vol. 28, No. 5, 981-2 (May, 1958).

It is suggested that the search for spectroscopic evidence of polymers of lithium halides in the equipment of Klemperer and Rice (Abstr. 4151/1957) is not a critical test of the reality of their occurrence. W.Good

535.343

6844. HYDROGEN FLUORIDE POLYMER SPECTRUM, HEXAMER AND TETRAMER. D.F.Smith.
J. chem. Phys., Vol. 28, No. 6, 1040-56 (June, 1958).

Experimental results at various pressures at temperatures from −70°C to 73°C are presented. The more important qualitative features noted are: (1) the absorption is strongly dependent upon both the temperature and pressure; (2) in some cases the shape of the bands is dependent upon the pressure; (3) at low temperature only very low pressures of vapour (hence of polymer) are necessary to observe some absorption. The application of Dalton's law, the law of mass action, Lambert's law, and Beer's law, as well as Van't Hoff's equation to the hydrogen fluoride monomer–polymer system is discussed. It is then shown that under some special circumstances the absorption varies simply as the fourth power of the pressure, under others as the sixth power of the pressure, but more generally where the absorption is strong as the sum of two terms, one containing the fourth power of the pressure the other the sixth power. The absorption thus corresponds to the overlapping spectra of a tetramer and of a hexamer, which can be separated on the basis of this pressure dependence. From the temperature variation of the absorption, the heats of polymerization are estimated as $\Delta H_4 = -19$ kcal/mole and $\Delta H_6 = -$ kcal/mole. In general, the absorption outside the range of monomer absorption is as consistent with a tetramer–hexamer interpretation for deuterium fluoride as for hydrogen fluoride. A.

535.343

6845. APPLICATION OF PRESSED POWDER METHODS TO INVESTIGATIONS OF INFRARED ABSORPTION SPECTRA OF SOLIDS. W.Szymanowski, R.Wiśniewski, R.Gołębiowski and I.Olszewska.
Bull. Acad. Polon. Sci. Sér. Sci. math. astron. phys., Vol. 6, No. 3, 223-31 (1958).

Observed infrared spectra for barium titanate, polystyrene, coals with different carbon content, and inositol are graphically presented and interpreted. The samples were prepared for investigation by pressing in a vacuum mould with KBr.

G.I.W.Llewelyn

535.343

6846. INFRARED SPECTRUM OF $Ca(OH)_2$.
W.R.Busing and H.W.Morgan.
J. chem. Phys., Vol. 28, No. 5, 998-9 (May, 1958).

Measurements were made on single crystals in different crystal directions in the range from 3000 to 4200 cm^{-1}. Some only of the observations conform with the model suggested by the crystal structure deduced from neutron diffraction. G.F.Lothian

535.343 : 537.311.32

6847. THE ABSORPTION OF ZnO CRYSTALS IN THE INFRARED.
R.Arneth.
Naturwissenschaften, Vol. 45, No. 12, 282 (1958). In German.

Single crystals show gradually increasing absorption between 1 and 12 μ, with peaks at 10.1 and 11.5 μ. Heating to 600°-800° C in H_2 shows increasing general absorption (K) and increasing electrical conductivity (σ). There is a linear relation between ΔK at a particular wavelength and $\Delta\sigma$. G.F.Lothian

535.343

6848. INTENSITY MEASUREMENTS IN THE MICROWAVE SPECTROSCOPY OF GASES. A.Dymanus.
University of Utrecht Dissertation (1958) 160 pp.

The antimodulation method for the precision measurement of absorption intensities in the 1.25 cm wavelength region has been used with a new type of Stark cavity spectrometer. Relative and absolute intensity results are given for 7 lines of carbonyl sulphide, 11 lines of CH_3OH, and 6 lines of $N^{15}H_3$. Accurate results were obtained only for COS, and for three lines of CH_3OH and these intensities differ from calculated values by discrepancies greater than experimental error. G.I.W.Llewelyn

535.343

6849. THE INVERSION SPECTRA OF $N^{14}H_3$.
H.G.Fitzky, R.Honerjäger and W.Wilke.
Z. Phys., Vol. 149, No. 4, 471-9 (1957). In German.

Thirty new lines in the inversion spectrum were found in the frequency region from 13 000 to 7000 Mc/s with a microwave spectrometer of high sensitivity. A correction formula is given by means of which the frequency of all known $N^{14}H_3$ lines may be estimated within 1 Mc/s. The theory of Nielsen and Dennison of the anomaly of K = 3 lines has been tested and a corresponding anomaly found for the K = 6 lines. R.C.Seymour

535.343

6850. MICROWAVE SPECTRUM OF CHLOROBENZENE.
H.Selén.
Ark. Fys., Vol. 13, Paper 6, 81-3 (1957).

535.343 : 539.19

6851. MICROWAVE SPECTRUM OF $CH_2DCH : CH_2$; EQUILIBRIUM CONFORMATION OF PROPYLENE.
D.R.Herschbach and L.C.Krisher.
J. chem. Phys., Vol. 28, No. 4, 728-9 (April, 1958).

By observation of this spectrum the staggered conformation of the methyl H atoms with respect to that in the CH group in propylene is demonstrated to hold. J.Hawgood

535.343.9 : 538.615

6852. DIRECT TRANSITION EXCITON AND FINE STRUCTURE OF THE MAGNETO-ABSORPTION SPECTRUM IN GERMANIUM.
S.Zwerdling, L.M.Roth and B.Lax.
Phys. Rev., Vol. 109, No. 6, 2207-9 (March 15, 1958).

Reports the first experimental results using a 4 μ specimen of Ge at 4.2°K with the magnetic induction along the [100] axis and the surface. The transitions concerned in the fine structure are all capable of theoretical explanation. C.A.Hogarth

535.343.9 : 535.375.5

6853. RAMAN SPECTRA OF GROUP VI HEXACARBONYLS.
A.Danti and F.A.Cotton.
J. chem. Phys., Vol. 28, No. 4, 736 (April, 1958).

The compounds of Cr, Mo, and W were used in $CHCl_3$ solution.

Raman frequencies, approximate intensities and tentative assignments are tabulated. Some of these do not accord with assignments of Hawkins et al. (Abstr. 1982/1956). G.F.Lothian

535.343.9 : 535.375.5

6854. RAMAN SPECTROSCOPY IN LIQUID AMMONIA SOLUTIONS VIBRATIONAL FREQUENCIES AND FORCE CONSTANTS FOR ISOTOPIC SPECIES OF THE BOROHYDRIDE ION HAVING TETRAHEDRAL SYMMETRY. A.R.Emery and R.C.Taylor.
J. chem. Phys., Vol. 28, No. 6, 1029-32 (June, 1958).

All fundamentals of the ions $^{11}BH_4^-$, $^{11}BD_4^-$, $^{10}BH_4^-$, and $^{10}BD_4^-$ were observed in the Raman spectra of some alkali metal salts dissolved in liquid NH_3 or ND_3 at -50°C. A complete assignment of all observed frequencies is made and force constants calculated by the FG method of Wilson. A.

535.343.9 : 535.375.5

6855. INVESTIGATION OF INTENSITY AND LINE BREADTH OF RAMAN SPECTRA FROM BENZENE AND CARBON DISULPHIDE. N.I.Rezaev and R.Mezhetskiĭ.
Optika i Spektrosk., Vol. 4, No. 1, 95-8 (1958). In Russian.

A brief description of the experimental details is given and the results in table form are compared with theoretical predictions. L.Bovey

535.343.9 : 535.375.5

6856. THE PRACTICE AND RESULTS OF PHOTOELECTRIC RECORDING OF RAMAN SPECTRA. J.Brandmüller and H.Moser.
Z. angew. Phys., Vol. 9, No. 11, 567-94 (Nov., 1957). In German.

The peak and integrated intensities of a line are defined and lines often regarded as standards of intensity are listed. The effects of various parameters on measured intensities are discussed: volume of specimen, refractive index of specimen and containing tube, temperature of specimen, absorption in the specimen, polarization, spectral sensitivity of the detector, and recording speed. The relation between the two intensities is discussed in terms of the profiles of the Raman and exciting lines and the performance of the monochromator. Intensity measurements on some hydrocarbons are quoted and the errors discussed. Applications to quantitative analysis and to structural problems are considered, together with the determination of polarizabilities and intermolecular forces. 123 references. G.F.Lothian

535.345 : 539.2

6857. ON THE OPTICAL ABSORPTION OF FERRIC ALUM AT LOW TEMPERATURES. R.Pappalardo.
Nuovo Cimento, Vol. 8, No. 6, 954-8 (June 16, 1958).

The optical absorption of ferric alum crystals was investigated to check the predictions of the crystal field theory for $3d^5$ systems. The agreement is not as good as for crystals with Mn^{2+}, but this difference is ascribed to the presence of electron transfer in the Fe^{3+} case giving rise to a strong admixture of $3d^5$ and $3d^6$ states. B.T.M.Willis

535.345 : 535.323

6858. ABSORPTION AND DISPERSION OF LIGHT IN CRYSTALS OF DIPHENYL AT 20.4° K. M.S.Brodin.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 53-60 (1957). In Ukrainian.

Polarized light absorption curves and dispersion were obtained for a diphenyl crystal at 293° and 20.4° K. In the absorption region the structure of the dispersion curves corresponds to that of the absorption curves. The oscillator strengths of the a- and b-components of the first three transitions of the spectrum are determined from the curves. C.R.S.Manders

535.345 : 532.77

6859. ON LOCAL OSCILLATIONS. V.V.Lytvynenko.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 371-3 (1957). In Ukrainian.

Theoretical note, based on the Davȳdov theory (Abstr. 7313/1954), deriving an expression for decay of local oscillations. C.R.S.Manders

535.345 : 539.234

SPECTRAL TRANSMISSION CURVES FOR BORON FILMS. See Abstr. 6443

535.345.6

6860. INDIUM ANTIMONIDE INFRARED FILTER. J.M.Powell and S.W.Kurnick.
J. appl. Phys., Vol. 29, No. 7, 1129-30 (July, 1958).

A filter with a maximum transmission at 9 μ was made from a single crystal of n-type InSb with a donor concentration of 10^{17} cm^{-3}, covered with an anti-reflection coating of As_2S_3. The maximum transmission, which without the coating was 27% at 25° C, was 55% at 25° C and 60% at 0° C. B.T.M.Willis

535.347 : 539.19

6861. INTERPRETATION OF INFRARED DICHROISM IN AXIALLY ORIENTED POLYMERS. R.D.B.Fraser.
J. chem. Phys., Vol. 28, No. 6, 1113-15 (June, 1958).

Although the actual distribution of chain directions in a partially oriented polymer cannot be determined from observations of infrared dichroism it is desirable to express the results in terms of a plausible model. A general relation between dichroic ratio and the parameter describing any model distribution is derived and applied to a number of suggested distributions. None are found to give plausible density functions for chain directions and a model based on the orientation of crystallites in a stretched polymer is suggested as a more suitable representation. A.

535.347 : 539.19

6862. STREAMING DICHROISM IN POLYMER SOLUTIONS: THE CALCULATION OF RESULTS. G.R.Bird.
J. chem. Phys., Vol. 28, No. 6, 1155-8 (June, 1958).

Streaming dichroism of the infrared absorption bands of polymer solutions was observed by flowing the solutions through a modified infrared cell. The calculation of orientation and dichroism as a function of streaming gradient resembles the calculation for streaming birefringence, but is not identical. This calculation is performed for ellipsoidal particles, and the results tabulated for the special case of rods with high axial ratio. A.

535.347

6863. THE DICHROISM OF CERTAIN POLYCYCLIC CRYSTALS. M.S.Brodin.
Ukrayin. fiz. Zh., Vol. 1, No. 4, 376-81 (1956). In Ukrainian, with summary (½ p.) in Russian.

Working with single crystals of stilbene and tolane, absorption, dispersion and reflection were measured in polarized light at room temperatures and at liquid nitrogen temperature. The specimens were of thickness 0.25-0.35 μ grown by a sublimation technique. From the absorption and dispersion curves the strengths were estimated of the oscillations of first and second transistions in stilbene and for the first transition for tolane. For the first electron transition in stilbene the strength of the oscillator polarized along the direction of the greatest refractive index component is approximately 5 times that along the axis of lowest refractive index. For tolane the ratio is 6.4. C.R.S.Manders

535.361.2

6864. DIFFUSE REFLECTION FACTOR OF POLYPARTICULATE SUSPENSIONS. A.Dognon and P.Suquet.
C.R. Acad. Sci. (Paris), Vol. 246, No. 5, 736-8 (Feb. 3, 1958). In French.

The theory of a previous paper (Dognon and Suquet, J. Chim. phys., 10, 815, 1957) is extended to cover a suspension containing several types of particle. It is tested with measurements on a suspension of erythrocytes and yeast cells in saline. It is stated that methods of oximetry by measurement of reflection from the skin must be reconsidered in the light of the theory. G.F.Lothian

535.37

6865. THE TEMPERATURE DEPENDENCE OF THE LUMINESCENCE-QUANTUM OUTPUTS OF SOLID SOLUTIONS OF CONDENSED HYDROCARBONS. O.M.Faĭdȳsh and I.Ya.Kucherov.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 68-77 (1957). In Ukrainian, with summaries (1 p.) in Russian and (1 p.) in English.

An account is given of studies of the temperature variation of the quantum outputs of solid solutions of naphthalene in anthracene and of anthracene in naphthalene, for various wavelengths of exciting light. Qualitatively the two pairs behave alike, quantitatively, they differ markedly. C.R.S.Manders

535.37 : 535.343 : 535.33

GENERAL RELATIONSHIPS BETWEEN ABSORPTION AND EMISSION FOR THE MODULATION SPECTRA OF POLYATOMIC MOLECULES. See Abstr. 6807

535.371

6866. THE LIGHT EMISSION OF MIXED TUNGSTATE PHOSPHORS. H.Witzmann and W.Plamann.
Exper. Tech. der Phys., Vol. 6, No. 1, 10-17 (1958). In German.

The mixed phosphor system $CaWO_4$—$CaSiO_3$ shows the $CaWO_4$ emission, but this reaches a maximum for about 25 mol % of SiO_2 content. With lead and manganese present characteristic activator bands occur in addition to the tungstate emission, the latter being most intense for a 45 mol % content of SiO_2. The red manganese emission is a maximum for 80 mol % of SiO_2. In the case of zinc tungstate—zinc silicate mixtures increase in the tungstate component causes a decrease in the green emission of the manganese impurity. G.F.J.Garlick

535.371

6867. TRANSFER OF MOLECULAR ENERGY BETWEEN SOLUTES IN LIQUIDS. J.B.Birks.
J. chem. Phys., Vol. 28, No. 4, 730-1 (April, 1958).

Weinreb (see Abstr. 984/1958) has concluded that the transfer of energy between two types of fluorescent molecule in a solution used for a scintillation counter is mainly non-radiative at high concentrations. The present author thinks the conclusion is invalid because no account was taken of apparent reduction of efficiency of fluorescence by self-absorption of the fluorescence, and that the function of the secondary solute is to absorb the emission of the primary solute and to re-emit the energy at longer wavelengths. G.F.Lothian

535.371

6868. TRANSFER OF MOLECULAR ENERGY BETWEEN SOLUTES IN LIQUIDS. A.Weinreb.
J. chem. Phys., Vol. 28, No. 4, 731-2 (April, 1958).

See preceding abstract. The author does not agree that self-absorption is important in this case. All the primary fluorescence is produced very close to the entrance window so that about half of it is lost out of the entrance window, hence a transfer efficiency of 81% cannot be explained by radiation alone. Also no fluorescence except that near the entrance window could be observed.
G.F.Lothian

535.371

6869. POSSIBILITY OF LUMINESCENT QUANTUM YIELDS GREATER THAN UNITY. D.L.Dexter.
Phys. Rev., Vol. 108, No. 3, 630-3 (Nov. 1, 1957).

It is shown that an excited sensitizer can transfer its energy simultaneously to two activators, under suitable conditions, leading to two emitted photons per incident higher energy photon. The probability of this transfer process is computed, and the process is shown to be experimentally feasible. A.

535.371

6870. THE LUMINESCENCE OF MIXED NAPHTHALENE—ANTHRACENE CRYSTALS. V.N.Vyshnevs'kyĭ.
Ukrayin. fiz. Zh., Vol. 1, No. 3, 294-307 (1956). In Ukrainian, with summary (1 p.) in Russian.

Measurements were made to establish the dependence of the distribution in the luminescence spectrum upon the variation of anthracene concentration. Quantum luminescence output determinations were carried out at concentrations of 8×10^{-7} to 5×10^{-3} mole of anthracene per mole of naphthalene. The experimental curves compare satisfactorily with those derived theoretically by Birks, Davydov, Borisov. It is suggested that in scintillation counters for nuclear radiation the anthracene crystal can be replaced by a liquid nitrogen cooled naphthalene crystal having 3×10^{-3} parts of anthracene. C.R.S.Manders

535.371

6871. DIFFUSION LENGTH OF EXCITONS IN ANTHRACENE CRYSTALS. V.M.Ahranovych, I.Ya.Kucherov and O.M.Faĭdysh.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 61-7 (1957). In Ukrainian.

Results are tabulated for the luminescence output of solid solutions of naphthalene in anthracene. Expressions are given for the variation of quantum efficiencies of anthracene and naphthalene luminescence with naphthalene concentration and with the absorption coefficient for the exciting light. Assuming a diffusion length for excitons in anthracene of about 15 μ it is possible to obtain an expression (verified experimentally) for the variation of the quantum efficiencies with concentration. C.R.S.Manders

535.371

6872. THE LUMINESCENCE OF CdS CRYSTALS.
V.V.Yeremenko.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 382-3 (1957). In Ukrainian.

Critical note on the major papers published in 1955-57.
C.R.S.Manders

535.371.07 : 621.385.832

6873. INFLUENCE OF BINDERS UPON THE SURFACE BRIGHTNESS OF CATHODE-RAY TUBE SCREENS. II.
I.Hangos and G.Pozsgay.
Acta tech. Hungar., Vol. 20, No. 1-2, 129-36 (1958).

Continuing previous work (see Abstr. 2983/1958), the loss of brightness has been studied for willemite screens settled in potassium silicate with Ca, Sr or Ba nitrate as coagulant. Curves show the brightness to decrease with increasing coagulant concentration, and the more so for lower accelerating voltage. Brightness decreases less if K_S, the ratio of silica to potash in the binder, is increased. When this ratio is low the Sr and Ba salts are much more effective than the Ca in decreasing the brightness; but when K_S is high all three coagulants behave similarly. S.T.Henderson

535.371.08

6874. THE MEASUREMENT OF THE DECAY OF PHOSPHORS WITH A NEW PHOSPHOROSCOPE. D.Hahn and H.J.Kösel.
Z. angew. Phys., Vol. 9, No. 3, 137-40 (March, 1958). In German.

Measurements of decay times in the range from 10^{-1} to 10^{-4} sec were made with a phosphoroscope, in which the exciting and emitted light passed through the same chopping disk. The excitation period, intensity and frequency, and the ratio of excitation to dark period could be varied. J.Franks

535.372

6875. FLUORESCENCE SPECTRA OF URANIUM, NEPTUNIUM AND CURIUM.
J.G.Conway, J.C.Wallmann, B.B.Cunningham and G.V.Shalimoff.
J. chem. Phys., Vol. 27, No. 6, 1416-17 (Dec., 1957).

For earlier work see Abstr. 274, 1202 (1957). The ultraviolet-excited spectra of U^{3+} (9 lines), Np^{3+} (11 lines) and Cm^{3+} (7 lines) in crystalline $LaCl_3$ are recorded, also 4 absorption lines of Cm^{3+}, all within the range 3700 and 7000 A. In the case of Cm^{244} the radioluminescence spectrum is identical with that under ultraviolet. Levels are assigned to the observed lines. S.T.Henderson

535.372

6876. ON THE QUESTION OF ENERGY TRANSFER IN SOLID POLY-ACENE SOLUTIONS. A.Schmillen.
Z. Phys., Vol. 150, No. 2, 123-33 (1958). In German.

Solid solutions of tetracene, anthracene, chrysene or pairs of these in naphthalene, anthracene, fluorene or chrysene, were excited by u.v. radiation at 3131 or 3660A. Emission spectra are given and the effects of solute concentration and exchanges between two solutes are discussed. Decay rates were studied by means of phase changes (see Abstr. 6650/1953). It is considered that the absorption of primary-solvent fluorescence by the solute is negligible, but that excitons transfer the absorbed energy from solvent to solute. Transfers between two solutes depend on dipole—dipole exchanges. Calculation shows the mean diffusion path of an exciton in chrysene to be about 55 lattice spacings. S.T.Henderson

535.373

6877. ON THE ACTIVATION OF CADMIUM IODIDE WITH LEAD IODIDE. G.Monod-Herzen.
C.R. Acad. Sci. (Paris), Vol. 246, No. 18, 2605-7 (May 5, 1958). In French.

Unactivated CdI_2 under u.v. excitation has an emission peak at 490 mμ. When PbI_2 is introduced, the peak shifts to 550 mμ and the emission increases in intensity with increasing activator content.
J.Franks

535.373

6878. THE POSSIBLE EXISTENCE IN ORGANOLUMINOPHORS OF SEVERAL PHOSPHORESCENCE LEVELS.
V.A.Pilipovich and B.Ya.Sveshnikov.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 1, 59-61 (1958). In Russian.

The usual assumption that only a single excitation level takes part in fluorescence appears to be invalid for certain complex organic systems (e.g. vitrified sugar activated with carbazole). Such materials were found to show marked differences in the degree of polarization in different parts of their phosphorescent emission spectrum, such as to suggest that at least two levels were concerned. This could explain observed departures of quenching curves from the exponential form required for a single level. C.H.L.Goodman

535.373

6879. ENHANCEMENT OF PHOSPHORESCENCE ABILITY UPON AGGREGATION OF DYE MOLECULES. E.G.McRae and M.Kasha.
J. chem. Phys., Vol. 28, No. 4, 721-2 (April, 1958).

Aggregation into polymers may increase phosphorescence at the expense of fluorescence. The ratio between the two depends on the relative rates of (1) singlet to triplet internal conversion, which is enhanced by spreading out of singlet levels on molecular aggregation; and (2) fluorescence emission, which varies according to the geometrical structure of the polymer. S.T.Henderson

535.376 : 539.1.07

DECAY TIME OF THE LUMINESCENCE OF A ZINC SULPHIDE NEUTRON DETECTOR FOR NEUTRON AND γ-RAY EXCITATION.
See Abstr. 6094

535.376

6880. THE MEMORY EFFECT IN THE ENHANCEMENT OF LUMINESCENCE BY ELECTRIC FIELDS. G.Destriau.
Z. Phys., Vol. 150, No. 4, 447-55 (1958). In German.

When the fluorescence of ZnCdS:Mn under X-rays is enhanced by a simultaneous a.c. field, it is found that if both exciting agents

are removed, the phosphor remains in a sensitized state for many hours. Renewal of the X-ray excitation alone gives a maximum emission within a few seconds, and this falls to the normal steady value of the fluorescence. The effect is best developed when the field is switched off after the X-rays, and it also depends on the length of the rest period and the intensity of X-ray dosage in the first and second exposures of the phosphor, but phase differences between X-rays and a.c. field have little effect. See Abstr. 4893/1958.

S.T.Henderson

535.39 : 537.222 : 621.397.3

6881. CONTRIBUTIONS TO THE THEORY OF EIDOPHOR PROCESSES. F.Mast.
Dissert. E.T.H. Zürich, No. 2355, 47 pp. (1956). In German.

Theoretical determinations of the characteristics of thin film deformation by electric fields and the effect on light transmission or reflection are made. A description is given of an Eidophor camera system, to which the theoretical derivations are applied and a sensitivity value obtained. G.F.J.Garlick

535.393

6882. ANOMALIES IN OPTICAL CONSTANTS.
C.v.Fragstein and H.Römer.
Z. Phys., Vol. 151, No. 1, 54-71 (1958). In German.

The observed anomalies in the optical constants of thin metal films arise from two separate effects. There is a structure effect as well as the "pure" alteration of the constants. These effects may be separated by measurements of the optical constants of gold and other sols which do not exhibit the structure effect. The anomalous optical constants are then found to agree with the values predicted by the classical dispersion theory. R.W.Fish

535.393 : 539.234

EFFECT OF GETTERING ON THE REFLECTIVITY OF ALUMINIUM FILMS. See Abstr. 6444

535.417 : 531.715

6883. REMARKS ON THE THREE SLIT METHOD.
A.C.S.van Heel.
Physica, Vol. 24, No. 6, 529-31 (1958).

The three-slit method of Zernike is adapted to the Françon crystal interferometer for the measurement of the thickness of a thin film of area as small as 0.1 mm^2. The advantage of placing the slits in the frontal focal plane is discussed. Thickness changes with time are reported for MgF_2 films. S.Tolansky

535.417

6884. AN ALGEBRAIC ELECTRONIC COUNTER FOR INTERFERENCE FRINGES. G.Ruffino.
R.C. Accad. Naz. Lincei, Vol. 22, No. 5, 602-5 (May, 1957).
In Italian.

A simple direction-sensitive counter is described, using dekatron tubes to give an immediate display of the fringe count. Details of the electronic circuit are given. R.W.Fish

535.42 : 534.39

6885. DIFFRACTION OF LIGHT ON ULTRASONIC WAVES OF LARGE AMPLITUDE. I.G.Mikhailov and V.A.Shutilov.
Akust. Zh., Vol. 4, No. 2, 174-83 (1958). In Russian.

At high sound intensities it is assumed that the wave changes from a sinusoidal to a saw-tooth shape. The effect of an acoustic field of the latter type upon the intensity distribution of the diffraction maxima of a beam of incident light is examined. Good agreement is obtained between predicted and experimental results. C.R.S.Manders

535.421

6886. ON THE ENERGY DISTRIBUTIONS OF DIFFRACTED LIGHT FROM PLANE GRATINGS. M.Seya and K.Goto.
Sci. of Light (Tokyo), Vol. 5, No. 3, 119-29 (Dec., 1956).

The energy distribution formula is derived and numerical calculations on several cases are carried out. The results are compared with the calculations of Stumm and Whalen. A.

535.43 : 535.51

6887. ON THE STATE OF POLARIZATION OF SCATTERED RADIATION AT GREAT DEPTHS IN A MEDIUM OBEYING RAYLEIGH'S LAW. J.Lenoble.
C.R. Acad. Sci. (Paris), Vol. 246, No. 6, 924-7 (Feb. 10, 1958).
In French.

The theory of Chandrasekhar is developed for the case of a medium that is absorbing. It is shown that as the absorption (as distinct from scattering) increases from zero, the polarization of the radiation at great depths also increases continuously from zero. G.F.Lothian

535.435

6888. AN INVESTIGATION OF MOLECULAR SCATTERING OF LIGHT IN ALCOHOL SOLUTIONS.
H.P.Roshchyna, M.M.Dadenkova and V.A.Tarapon.
Ukrayin. fiz. Zh., Vol. 1, No. 2, 183-92 (1956). In Ukrainian, with summary (1 p.) in Russian.

On the basis of X-ray studies solutions may be classified in three groups, (i) those with molecular miscibility of the components, (ii) non-miscible ditto, (iii) those with chemical interaction of the components. Observations were made on all three types, measurements being taken on the effects of temperature and concentration on the intensity of the isotropic and anisotropic parts of the Rayleigh scattering for solutions of alcohols in alcohols (e.g. ethyl in butyl alcohol) and for alcohols in solvents of different molecular structure (e.g. glycerol, acetone, benzene, carbon tetrachloride, dioxane). From the isotropic scattering isotherms it is possible to make deductions concerning the miscibility or non-miscibility of the components of the solutions. It is concluded that non-miscibility can arise from differences in dimensions of the component molecules of a solution. C.R.S.Manders

535.555 : 531.25

6889. A GEOMETRIC INTERPRETATION OF DOUBLE REFRACTION IN PHOTOELASTICITY. R.Plechata.
Acta tech. (Prague), Vol. 2, No. 3, 230-61 (1957).

The author first shows how the parameters necessary to define an elliptically polarized vibration can be represented geometrically by a Poincaré sphere (see Abstr. 9143/1954). The method is applied in detail to the problem of the passage of light through two doubly-refracting plates and then used to consider the case, which arises in photoelasticity work, of light passing through a plate subjected to stress in two dimensions. The treatment is theoretical throughout. H.G.Jerrard

535.65

6890. L/Y RATIOS IN TERMS OF C.I.E.-CHROMATICITY COORDINATES. C.L.Sanders and G.Wyszecki.
J. Opt. Soc. Amer., Vol. 48, No. 6, 389-92 (June, 1958).

In previous papers (Abstr. 9647/1957) a correlate for lightness (L) was found in terms of C.I.E.-tristimulus values for colours of approximately constant luminous reflectance (Y). L could be expressed by a second degree equation with X, Y, Z as variables. In the present study about 100 samples were selected to cover the gamut of existing surface colours. The lightness-equivalent neutrals were estimated by three observers for these colours under the same conditions as previously described. The original type of equation could not be used to fit the observational data because of the large differences in luminous reflectance among the samples. However, the L/Y ratios could be expressed by a second degree equation with chromaticity coordinates x, y as variables. This type of equation appears to be valid for all reflecting surface colours. A.

535.7

PHYSIOLOGICAL OPTICS. VISION. See under "Medical science. Human physiology". Decimal classification 612.84

535.8

6891. A HOLDER FOR THIN PLATES IN OPTICAL INSTRUMENTS. C.Kühne.
Z. InstrumKde, Vol. 66, No. 5, 92-4 (May, 1958). In German.

Thin glass plates, such as Schmidt correctors, are deformed under their own weight to an appreciable extent when held vertically. A method of holding them is described which reduces this to a minimum by distributing the weight uniformly around the whole circumference. The improvement to be expected is shown by a typical calculation. R.W.Fish

535.81

6892. THE POSSIBILITIES OF EVALUATING A TWO-DIMENSIONAL COLOUR-SCHLIEREN SYSTEM. U.Schmidt.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 4-5, 203-18 (1958).
In German.

The two-dimensional colour-schlieren has been used qualitatively. The theory of the system is given and methods of obtaining quantitative data are derived. One method needs a comparative exposure of a known object, the "standard" schlieren, to be taken. A second method is discussed in which this comparison is not in theory necessary. R.W.Fish

535.81

6893. USE OF IMAGES WITH STRONG NEGATIVE COHERENCE FOR INDICATION OF THE POSITION AND DEFECTS OF LINES.
A.Arnulf and O.Dupuy.

C.R. Acad. Sci. (Paris), Vol. 246, No. 16, 2350-2 (April 21, 1958). In French.

The line is in front of a parallel window illuminated by a narrow slit. The two slits into which the line divides the window form a system of interference fringes and the entrance pupil of the viewing system is a narrow slit adjusted to coincide with a dark fringe. The position of the dark fringe, and therefore the illumination of the entrance pupil, varies with the position of the line. A.H.Cook

535.81

6894. PHOTOELECTRIC INDICATOR FOR PRECISION SETTING IN CO-ORDINATE MEASUREMENTS [ON PHOTOGRAPHIC PLATES]. E.Djurle and G.Gran.
J. sci. Instrum., Vol. 35, No. 8, 304-5 (Aug., 1958).

The indicator presents the intensity in the line or point to be measured as mirror images on an oscilloscope and uses the traces as coincidence marks. Measurements can be made in two co-ordinate directions with a standard deviation of 0.3 μ or better for the setting on a line or point. A.

535.81 : 534.2

6895. AN OPTICAL SYSTEM FOR THE STUDY OF ULTRASONIC WAVES. E.G.D.Youngs.
Marconi Rev., Vol. 21, 2nd Qtr, 76-90 (1958).

The use of the schlieren technique to determine the velocity of elastic waves in transparent liquids and solids and in opaque solids is described. The principal elastic constants for copper, cerroseal, indium and Fry's fusible alloy No. 7 are given. H.D.Parbrook

535.81

6896. A NEW THERMAL IMAGE-CONVERTER. W.R.Harding, C.Hilsum and D.C.Northrop.
Nature (London), Vol. 181, 691-2 (March 8, 1958).

This uses the temperature-dependence of the absorption edge of amorphous selenium. If a 1 μ thick self-supporting film is viewed in transmission by light from a sodium lamp, any warm areas of the film will appear dark. The film is metallized and mounted in a vacuum, and an f/1 parabolic mirror is used to give images of hot objects. Objects 15 deg. C above ambient temperature can be seen. The time constant is less than 0.5 sec. C.Hilsum

535.81

6897. INVESTIGATION OF THE PROPAGATION OF WAVES IN OPTICAL WAVEGUIDES. B.S.Skorobogatov.
Optika i Spektrosk., Vol. 3, No. 3, 272-80 (1957). In Russian.

Propagation of light between two metal surfaces, situated at a distance of the order of the light wavelength was studied. It is shown that such systems possess, for light waves, all the characteristic properties of waveguides. The critical wavelengths were measured as a function of the distance between the guiding surfaces. A peculiar spectral distribution in the diffraction maxima at the open end was discovered and studied; the phase velocity of the waves was measured by means of this effect. An interference-polarization phenomenon was discovered; it is shown that it is due to the interference of E and H waves. The experimental results are compared with the theoretical results obtained from the calculation of a plane waveguide taking into account the complex dielectric constant of the metal.

535.822.17

6898. A PHASE-CONTRAST MICROSCOPE FOR THE MEASUREMENT OF PHASE AND AMPLITUDE EFFECTS OF ISOLATED OBJECTS. U.Gradmann.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 4-5, 238-54 (1958). In German.

A microscope arrangement is described in which the normal phase-plate is replaced by a mica ring, with polarizing elements in the beam. The system allows the optical thickness and absorption of single isolated objects to be measured from the ellipticity of the image. Practical details of the equipment are given, together with the results of measurements made upon glass fibres of 1-6 μ in diameter immersed in various fluids. R.W.Fish

535.822.17 : 532.64.08

6899. STUDIES AND APPLICATIONS OF POLARIZED-LIGHT INTERFERENCE-MICROSCOPES. M.Françon.
Physica, Vol. 24, No. 6, 495-504 (1958). In French.

A descriptive review is given of the Françon polarized-light interference-microscope. An application described in detail is the measurement of surface-tension angle of contact by an interferometric procedure. Small local variations in angle of contact against a plane are detected. S.Tolansky

535.88 : 529.78

PROJECTION SYSTEM FOR CLOCK DIAL. See Abstr. 6610

HEAT

536.2.01

6900. PARADOXES IN THE CONTINUOUS THEORY OF THE HEAT EQUATION. P.Vernotte.
C.R. Acad. Sci. (Paris), Vol. 246, No. 22, 3154-5 (June 2, 1958). In French.

Fourier's treatment of heat transfer assumes that the transfer mechanism is established instantaneously in all circumstances. This is stated to be a basic difficulty in the application to real substances. A general solution in one dimension of the problem considered in Abstr. 3730 (1948) using

$$-\lambda\frac{\partial T}{\partial x} = \phi + \tau\frac{\partial \phi}{\partial t},$$

where ϕ is the heat flux density, and λ the conductivity, in place of Fourier's relation, is obtained in the form

$$(\lambda/c\rho)\frac{\partial^2 T}{\partial x^2} - \tau\frac{\partial^2 T}{\partial t^2} - \frac{\partial T}{\partial t} = 0,$$

where c and ρ are the specific heat and density respectively. S.Weintroub

536.21 : 548

6901. THERMAL CONDUCTIVITY OF SODIUM FLUORIDE CRYSTAL AT LOW TEMPERATURES. A.F.Cohen.
J. appl. Phys., Vol. 29, No. 5, 870 (May, 1958).

The specimen measured had cleaved surfaces and was 2.0 cm long and 7.38 mm^2 cross-section. The graph shown of thermal conductivity (k) against temperature covers the range from 3 to 300°K and shows that for temperatures above that for which k is a maximum, k decreases exponentially with temperature. S.Weintroub

536.212 : 536.413

6902. THERMAL CONDUCTIVITIES AND EXPANSION COEFFICIENTS OF WATER AND ICE. R.W.Powell.
Advances in Phys., Vol. 7, 276-97 (April, 1958).

A comprehensive and critical review of the experimental methods, measurements and data. Separate sections are devoted to the thermal conductivity of water (0°-90°C), supercooled water, water (90°-370°C), heavy water, ice, solid D_2O; the influence of pressure on the thermal conductivity of water; the density of water and of heavy water; and the thermal expansion of ice. S.Weintroub

536.212 : 537.323

THERMAL CONDUCTIVITY OF A STATISTICAL MIXTURE. See Abstr. 5934

536.212.3

6903. THE TEMPERATURE DEPENDENCE OF THE THERMAL CONDUCTIVITY OF SELENIUM WITH ADMIXTURE OF CHLORINE. G.M.Aliev and G.B.Abdullaev.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 1, 76-8 (1958). In Russian.

Samples of semiconducting material were prepared from purified selenium without or with admixture of small quantities of selenium tetrachloride. The thermal conductivity of these samples was measured between 30 and 80°C. At a constant concentration of chlorine the thermal condcutivity appears to depend linearly on the temperature over wide ranges, but not at all concentrations and temperatures. At constant temperature the thermal conductivity decreases with increasing chlorine content, passes through a minimum and rises again. Graphs obtained by plotting the thermal conductivity against the electric conductivity at constant temperature and varying content of chlorine show a minimum. R.Eisenschitz

536.23 : 536.633 : 533.16

SENFTLEBEN DETERMINATION OF THE THERMAL CONDUCTIVITY OF GASES. See Abstr. 6714

536.252

6904. EFFECTS OF LATERAL BOUNDARIES ON NATURAL CONVECTION. R.K.Soberman.
J. appl. Phys., Vol. 29, No. 5, 872-3 (May, 1958).

Silicone oil, 1 in. deep, contained in an 8 in. diameter cylinder consisting of a Pyrex tube clamped on to a $\frac{1}{4}$ in. Cu plate heated from below, was used. To observe the effect of lateral boundaries two sleeves, a 5.6 in. diameter Pyrex tube and a Plexiglass tube of rectangular form, 5.6 × 4.7 in., were separately inserted into the oil and the flow patterns were observed by light reflected from a small quantitiy of Al powder suspended in the oil. The motion of the fluid was recorded photographically, and photographs at the onset of natural convection and after $3\frac{1}{2}$ hr are shown. The shape of the cellular forms is definitely influenced at the onset by the lateral

geometry of the fluid container, but not when the convection has proceeded for some time. S.Weintroub

536.252 : 532.513

THERMAL CONVECTION IN A ROTATING LIQUID. See Abstr. 6689

536.4.031

6905. ON THE LIMIT OF SUPERHEAT.
H.Wakeshima and K.Takada.
J. appl. Phys., Vol. 29, No. 7, 1126-7 (July, 1958).

A method for the observation of the limit of superheat of liquids is briefly described. A column of liquid, of greater density and higher boiling point than the sample liquid, is heated at the upper end and a stable temperature gradient maintained in the column. Droplets of the sample liquid are introduced into the lower end of the column through a small hole in the container and the height at which the droplets reach the limit of superheat and explode is measured. A column of sulphuric acid was used for normal pentane and normal hexane, and glycerine for ethyl ether. The limits of superheat, 110°C, 116°C and 118°C respectively, were definite. S.Weintroub

536.413 : 539.32 : 539.374

INFLUENCE OF PLASTIC DEFORMATION ON EXPANSIVITY OF ALUMINIUM. See Abstr. 6451

536.413 : 536.212

EXPANSION COEFFICIENTS OF WATER AND ICE. See Abstr. 6902

536.421.1

6906. MELTING TEMPERATURE OF CONTACT LAYERS IN CRYSTALS. P.A.Savintsev and V.E.Avericheva.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 5, 936-7 (1958). In Russian.

The temperatures at which fusion occurred in the contact planes of various pairs of alkali-metal halides were determined and tabulated, both for pairs forming eutectic compounds and for those forming solid solutions. When specimens were first heated to the "contact fusion temperature", fusion occurred only when the actual contact took place. F.Lachman

536.421.4

6907. THE SUPERCOOLING AND NUCLEATION OF WATER.
B.J.Mason.
Advances in Phys., Vol. 7, 221-34 (April, 1958).

Recent experimental and theoretical work is reviewed, including the supercooling of water containing foreign particles (heterogeneous nucleation), homogeneous nucleation, and the properties of freezing nuclei. A tabular summary is given of the experimental data on the supercooling of water samples to very low temperatures, probably to the threshold of homogeneous nucleation, and the crystal structures of the most efficient ice nucleating substances are listed. The evidence for the supercooling of water below −40°C is discussed. S.Weintroub

536.421.4 : 534.232

6908. FREEZING OF DROPS OF A SUPERCOOLED WATER MIST IN AN ACOUSTIC FIELD. V.V.Bazilevich and N.P.Tverskoĭ.
Zh. tekh. Fiz., Vol. 27, No. 8, 1826-9 (1957). In Russian. English translation in: Soviet Physics — Technical Physics (New York), Vol. 2, No. 8, 1696-9 (Aug., 1957).

Experiments to show that supercooled water mists (drop diameters 1.6 to 30 μ) between −4° and −5°C crystallize more rapidly in an acoustic field generated by a siren (frequency: 1 to 15 kc/s; pressure on axis 150 cm from siren: 110 bars at 10.1 kc/s). H.D.Parbrook

536.422

6909. "DEPOSITION" — A PROPOSED ANTONYM FOR "SUBLIMATION". J.E.McDonald.
J. chem. Phys., Vol. 28, No. 1, 170 (Jan., 1958).

It is pointed out that in contrast to the antonymous pairs "freezing—melting" and "condensation—evaporation", each term representing a one-way process, the term "sublimation" is often used to indicate processes in both directions. It is concluded that "sublimation" should mean only solid → vapour, and that "deposition" should indicate vapour → solid transitions. P.Gray

536.422 : 539.529

6910. THE DEVELOPMENT OF AN ELECTRIC-WIRE EXPLOSION STUDIED WITH THE HELP OF A KERR-CELL CAMERA. W.Müller.
Z. Phys., Vol. 149, No. 4, 397-411 (1957). In German.

A copper wire of 0.004 cm diameter was exploded by discharging through it the energy stored in a 0.1 μF capacitor. The explosion was recorded by a Kerr-cell camera with 0.25 μsec exposure-time, a schlieren system being used with flash illumination. During the first microsecond the wire vaporized and short arcs formed at discontinuities. The current ceased to flow for about a microsecond until the vapour had expanded. Then a shock-wave separated from the exterior of the vapour and an electrical discharge occurred in the interior. The discharge was well formed after 3 μsec. Further shock-waves were formed. The rates of growth of various parts of the discharge were measured. E.R.Wooding

536.422 : 537.529

6911. PHYSICAL PROCESSES IN ELECTRIC-WIRE EXPLOSIONS.
E.David.
Z. Phys., Vol. 150, No. 2, 162-71 (1958). In German.

Contains a theoretical discussion of the processes involved when the passage of a large current through a wire causes it to burst. The powerful magnetic field produced causes a very large pressure to exist on the axis of the wire and this keeps the wire liquid until the critical temperature is reached. A numerical example is calculated for a copper wire. A method is given of estimating the critical constants of metals. J.M.Hough

536.422.5

6912. THE CONDENSATION BEHAVIOUR OF HIGH MELTING-POINT SUBSTANCES. K.G.Günther.
Z. Phys., Vol. 149, No. 5, 538-49 (1957). In German.

A description is given of measurements made on SiO and B_2O_3 by a method in which the deposit on a metal plate at fixed temperature is compared with that on a similar plate whose temperature varies linearly along the length. Activation energies for the re-evaporation are deduced and these parameters exhibit sharp changes above certain critical temperatures in the region 300-400° C. A.H.W.Beck

536.423

6913. AN I—T-DIAGRAM OF NEON. W.Koeppe.
Z. angew. Phys., Vol. 8, No. 12, 581-5 (Dec., 1956). In German.

Available thermodynamic data are used for the construction of an I—T curve for neon, and using it certain success was achieved in the separation of helium (~ 20%)—neon (~ 80%) mixtures. Separate figures are included for the saturation and for the superheated regions of the I—T diagram, for the pV—p, $\left(\frac{V}{T}\right)_p - T$, $\frac{\partial}{\partial T}\left(\frac{V}{T}\right)_p - p$, inversion, and $\Delta I_T - p$ relationships of neon, and for the liquid-yield—p curve in the liquefaction of neon. 25 references. H.H.Hodgson

536.423.15

6914. VAPOR PRESSURES AND VAPOR DENSITIES FROM DIRECT WEIGHINGS OF KNUDSEN CELLS. J.L.Margrave.
J. chem. Phys., Vol. 27, No. 6, 1412-13 (Dec., 1957).

The principle is examined of a method based on measuring the force exerted by the effusing molecules when a Knudsen cell rests on the pan of a micro-balance in a vacuum. A micro-balance with a sensitivity of 1 μg could measure an equilibrium pressure of approximately 10^{-7} atm with a 0.01 cm^2 effusion hole area. Quantitative tests of the technique are in progress. W.Good

536.423.15

6915. AN INSTRUMENT FOR THE MEASUREMENT OF VAPOUR PRESSURE BELOW 1×10^{-2} TORR. A.Herlet and G.Reich.
Z. angew. Phys., Vol. 9, No. 1, 14-23 (Jan., 1957). In German.

Describes an instrument, usable over the range from room temperature to 250°C, for the simultaneous measurement of vapour pressure and rate of evaporation, from which the molecular weight can be deduced. Data for 19 substances (oils and greases) important in vacuum technique are given. The apparatus permits the determination of individual components of a mixture by continuous measurement of its vapour pressure at constant temperature. L.G.Carpenter

536.424.1

6916. APPLICATION OF ORDER—DISORDER CONCEPTS TO KINETICS OF DIFFUSIONLESS TRANSITIONS IN SOLIDS. J.M.Honig
J. chem. Phys., Vol. 28, No. 4, 723 (April, 1958).

The formulation of order—disorder theory due to Hijmans and de Boer (Abstr. 7715-17/1955) is adapted to the problem of diffusionless phase transformations. A general equation giving the extent of the change as a function of time is presented. In the limit corresponding to high aggregation of the product phase the equation reproduces the conversion curves of the white—grey transformation of tin. A.B.Lidiard

536.453 : 537.56

EXTREMELY HIGH TEMPERATURES. See Abstr. 5991

536.461 : 537.562

6917. MASS-SPECTROMETRIC OBSERVATIONS OF IONS IN HYDROCARBON FLAMES. P.F.Knewstubb and T.M.Sugden.
Nature (London), Vol. 181, 1261 (May 3, 1958).

Ions of hydrocarbon molecules and radicals of mass number up to 150, formed by rapid polymerization of fuel, were detected. Mass peaks are grouped around ions of type $C_nH_n^+$, where n varies between 3 and 10, odd mass numbers being most abundant. The evidence for polymerization may assist in the explanation of carbon formation. The ions are rapidly removed by oxygen in lean mixtures.
A.G.Gaydon

536.462

6918. THE DETERMINATION OF THE ELECTRON TEMPERATURE IN A RAREFIED FLAME.
V.S.Rossikhin and V.I.Tverdokhlebov.
Ukrayin. fiz. Zh., Vol. 1, No. 4, 389-94 (1956). In Ukrainian, with summary (½ p.) in Russian.

The apparatus and theory are given applying the method of two probes, measuring the volt–ampere characteristics of the space between them. Results are given for an acetylene–air flame, burning at 30 mm Hg pressure with a volume concentration of 6%. The electron temperature was found to be T = 1645°K. Repetition of the measurements at various heights in the flame gave readings concordant to within 2%.
C.R.S.Manders

536.48

6919. CONFERENCE ON PROBLEMS OF PHYSICS OF LOW TEMPERATURES. E.S.Borovik and V.L.Broude.
Ukrayin. fiz. Zh., Vol. 1, No. 1, 106-8 (1956). In Ukrainian.

Report on a conference held at the Institute of Physics of the Ukrainian Academy of Sciences, Kiev, 13-15 June 1955. Participating bodies are the Institute of Physical Problems of the Academy of Sciences of the U.S.S.R., Moscow and Physico-Technical Institute of the Ukrainian Academy of Sciences. There were 4 sessions devoted to: (i) He II — main papers by L.D.Landau and I.M.Lifshits, V.L.Ginzburg, B.N.Esel'son and N.G.Bereznyak. (ii) Electrical conductivity of metals — main papers by N.E.Alekseev, N.B.Brandt and T.I.Kostyna, P.A.Bezugliĭ and A.A.Galkin. (iii) The solid state — main papers by P.G.Strelkov and E.S.Gurevich, B.I.Verkin, B.G.Lazarev and A.N.Ovcharenko. (iv) Optical properties at low temperatures — main papers by I.V.Obreimov, A.F.Prikhot'ko, É.F.Grosos, A.F.Lubchenko. P.L.Kapitsa and B.G.Lazarev presided at the sessions.
C.R.S.Manders

536.48 : 536.42

6920. GENERALIZED PHASE RULE AND THE SYMMETRY OF THE SUPERFLUID STATE. L.Tisza.
Phys. Rev., Vol. 110, No. 2, 587-9 (April 15, 1958).

Phases which are otherwise identical may differ by symmetry, crystalline twin phases being a familiar example. The existence of these phases can be taken into account by assigning to a system a "symmetry number" which would ordinarily be zero. An ordered binary mixed crystal is regarded as a two-phase system, the phases consisting of domains with different type of order; these crystals are assigned a symmetry number equal to unity. Gibbs' deduction of the phase rule is reformulated so that the effect of the symmetry is taken into account. Broadly speaking a symmetry number equal to 1 gives rise to an additional degree of freedom. If two coexisting phases tend to become identical the boundary of their coexistence region is known as "critical phase". In vapour–liquid equilibrium the critical phase is restricted to a point. In accordance with the author's generalized phase rule the critical phase for an ordered crystal has one degree of freedom and is known as the λ-curve. On account of the similarity between the λ-transitions of liquid helium and of mixed crystals the author concludes that the ground state of liquid helium must be doubly degenerate, contrary to all current views on the nature of superfluids. The author qualifies his argument by asserting that the phase rule is not a direct consequence of the laws of thermodynamics.
R.Eisenschitz

536.48

6921. CORRELATION OF λ-POINTS AND PHASE SEPARATION TEMPERATURES IN ^{3}He–^{4}He SOLUTIONS. C.E.Hecht.
Physica, Vol. 24, No. 7, 584-8 (July, 1958).

It is predicted that above a certain critical value for He^3 mole fraction, X_3, in He^3–He^4 solutions no superfluid properties exist and that thus the T_λ v. X_3 curve should coincide with a plot of phase-separation temperature v. X_3 for large X_3.
A.

536.48 : 536.2

6922. EXPERIMENTS ON THE FLOW OF HEAT IN LIQUID HELIUM BELOW 0.7°K. R.W.Whitworth.
Proc. Roy. Soc. A, Vol. 246, No. 1246, 390-405 (1958).

The steady flow of heat in liquid helium in tubes of diameter 0.05 to 1.0 cm at temperatures between 0.25 and 0.7°K was studied. The results are interpreted in terms of the flow of a gas of phonons, in which the mean free path λ varies with temperature, and may be either greater or less than the diameter of the tube d. When $\lambda \gg d$ the flow is limited by the scattering of the phonons at the walls, and the effect of the surface was studied, but when $\lambda \ll d$ viscous flow is set up in which the measured thermal conductivity is increased above that for wall scattering. This behaviour is very similar to that observed in the flow of gases at low pressures, and by applying kinetic theory to the problem it can be shown that the mean free path of the phonons characterizing viscosity can be expressed by the empirical relation $\lambda = 3.8 \times 10^{-3} T^{-4.3}$ cm. This result is inconsistent with the temperature dependence of λ as T^{-9} predicted theoretically by Landau and Khalatnikov (1949).
A.

536.48

6923. ON THE EFFECTIVE NORMAL FLUID DENSITY OF SOLUTION OF He^3 IN He^4. S.K.Trikha and V.S.Nanda.
Progr. theor. Phys., Vol. 17, No. 1, 126-8 (Jan., 1957).

Theoretical calculations of the concentration of the normal component in He^3–He^4 mixtures are carried out in accordance with the theories of de Boer and Gorter (Abstr. 5780/1950), of Mikura (Abstr. 8233/1954 and 6567/1956) and of the present authors (Abstr. 8740-1/1956). The latter show the best agreement with measurements by Pellam (Abstr. 9614/1955).
R.Eisenschitz

536.48

6924. ENERGY vs MOMENTUM RELATIONS FOR EXCITATIONS IN LIQUID HELIUM.
J.L.Yarnell, G.P.Arnold, P.J.Bendt and E.C.Kerr.
Phys. Rev. Letters, Vol. 1, No. 1, 9-11 (July 1, 1958).

These experiments are similar to those by Palevsky et al. (Abstr. 2277/1958). A beam of thermal neutrons was filtered with Be and allowed to strike a liquid He II target. The energy spectrum of neutrons scattered by a given angle was measured with a crystal spectrometer. From the shift in the Be energy cutoff and the change in momentum of the neutrons the excitation spectrum was obtained for wave numbers k between 0.55 and 2.36 A^{-1}. Excellent agreement with Cohen and Feyman's predictions (Abstr. 7827/1957) was found. Linear extrapolation from the value for the lowest k gives a first sound velocity of 240 m/sec (experimental 237 m/sec). The maximum of the energy E(k) occurs at $k = 1.10 \pm 0.04$ A^{-1}, with $E = 13.8 \pm 0.2$°K, and the minimum at $k = 1.93 \pm 0.04$ A^{-1}, with $E = 8.6 \pm 0.2$°K. From $k > 2.3$ A^{-1} the spectrum becomes progressively smeared out. This has been expected, because rotons of higher energy tend to break up into a phonon and roton of lower energy.
H.London

536.48

6925. DENSITY OF He^3–He^4 SOLUTIONS. T.P.Ptukha.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 33-8 (1958). In Russian.

Temperature dependence of the density of He^3–He^4 solutions subjected to the pressure of saturated vapour was measured at He^3 concentrations of 10, 20.1, 30.3, 41.2, 49.9, 68.5 and 85.4%. The λ-point temperatures for concentrations of 10, 20.1, 30.3 and 41.2% were estimated on basis of the break in the ρ(T) curve.
A.

536.483 : 535.33.07

6926. GLASS DEWARS FOR OPTICAL STUDIES AT LOW TEMPERATURES. L.J.Schoen, L.E.Kuentzel and H.P.Broida.
Rev. sci. Instrum., Vol. 29, No. 7, 633-8 (July, 1958).

All glass or predominantly glass vessels are well suited to spectroscopic or photochemical studies down to temperatures as low as 1.2°K. The choice of glass offers advantages of economy and simplicity in addition to allowing for a large degree of flexibility to be incorporated into a given design. A number of such Dewars are described and their relative merits discussed. It is shown that the heat-leak arising from the optical arrangement is, in general, not serious.
A.

536.62

6927. HEAT OF BULB BREAKING IN HEAT-OF-IMMERSION CALORIMETRY.
C.A.Guderjahn, D.A.Paynter, P.E.Berghausen and R.J.Good.
J. chem. Phys., Vol. 28, No. 3, 520-1 (March, 1958).

Experiments are described which show that most of the heat of bulb breaking can be accounted for by the term PV_b where P is the atmospheric pressure and V_b is the empty volume in the bulb.
W.Good

536.628.2

6928. THE ADIABATIC CALORIMETER — AN APPARATUS FOR THE SIMULTANEOUS DETERMINATION OF THERMAL CAPACITY AND THERMAL CONDUCTIVITY.

N.N.Sinel'nikov and V.N.Filipovich.
Zh. tekh. Fiz., Vol. 28, No. 1, 218-21 (1958). In Russian.

The calorimeter, which has been previously described (N.Sinel'nikov Dokl. Akad. Nauk SSSR, Vol. 92, 369, 1953) is a long cylinder; heat flows radially through the material studied, which is contained between two concentric cylinders; external heaters prevent loss of heat and end effects. The theory is given of the temperature transients which occur when the power to the heater on the cylinder axis is changed; it is shown how the thermal properties of the material may be obtained from experimental results. The application of the method to quartz powder is described; by experiments at various pressures of air it is shown that, of the heat transport at 300° C and 1 atm pressure, ~ 70% is by thermal convection in air pockets, ~ 20% by thermal conduction through the air, and only ~ 10% by thermal conduction through the quartz and by radiation. K.F.Hulme

536.631

6929. THE SPECIFIC HEATS OF GADOLINIUM AND TERBIUM BETWEEN 0.2° K AND 6° K. N.Kurti and R.S.Safrata.
Phil. Mag. (Eighth Ser.), Vol. 3, 780-3 (July, 1958).

Specpure metal ingots of approximately 20 g each were used, attached to a crystal of cerium magnesium nitrate and mounted on a german-silver tube within a demagnetization cryostat. The results for both metals are shown graphically. For Gd the specific heat (C) above 4° K agrees with that of Hofman et al. (J. Phys. Chem. Solids, Vol. 1, 45, 1956), but deviates markedly at lower temperatures. No anomaly due to hyperfine coupling was observed down to 0.2° K. For Tb, there is a rapid rise in C below 1° K which is likely to be due to hyperfine coupling and the nuclear contribution to C is represented by $CT^2/R = (24.8 \pm 1.2) \times 10^{-3}$. S.Weintroub

536.631

6930. THE SPECIFIC HEAT OF Mg–Zn FERRITE. M.S.Shul'ha.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 54-8 (1957). In Ukrainian.

The manufacture of the ferrite $MgO.ZnO.2Fe_2O_3$ is described. Measurements made over a temperature range from 0° to 400° C show that the specific heat varies linearly with temperature, except that in the region 150°-175° C it first rises and then falls, the jump being approximately 2R. The evidence shows the Mn–Zn ferrite to be clearly magnetic with Curie point close to 150° C. C.R.S.Manders

536.631 : 538.221

6931. THE SPECIFIC HEAT C_p OF ANTIFERROMAGNETIC MIXED CRYSTALS MnO–CoO. J.Hölzl.
Z. Phys., Vol. 151, No. 2, 220-32 (1958). In German.

Reports results of measurements between 100° and 300° K for pure MnO and CoO and two mixed crystals with x = MnO/(MnO + CoO) equal to 0.25 and 0.5. The values of C_p, plotted as a function of T/T_N, where T_N is the Néel temperature, lie on a unique curve. The variation of T_N with x is parabolic, and from its dependence the values of the Mn–Mn, Mn–Co and Co–Co exchange integrals were calculated to be −0.46, −1.04 and -2.66×10^{-3} eV respectively. E.P.Wohlfarth

536.631 : 537.226.2

THERMAL STUDY OF TRI-GLYCINE SULPHATE AND TRI-GLYCINE FLUOBERYLLATE. See Abstr. 5861

536.633 : 536.23 : 533.16

SENFTLEBEN DETERMINATION OF THE SPECIFIC HEAT OF GASES. See Abstr. 6714

THERMODYNAMICS

536.77

6932. ON ENTHALPY AND FREE ENERGY. C.Bory.
C.R. Acad. Sci. (Paris), Vol. 246, No. 16, 2352-5 (April 21, 1958). In French.

The relation between the internal and potential energies of a gas are discussed by analogy with the energies of a mass point in a gravitational field. The conclusion is that the internal energy is defined by the state of the system without any restriction, but that the interaction energy pv is the complement of −TS only where the transformations are very small. P.Gray

ELECTRICITY

ELECTROSTATICS. DIELECTRICS

537.217

6933. CALCULATION OF THE ELECTROSTATIC FORCE TENDING TO RAISE A CONDUCTING SPHERE FROM A CONDUCTING PLANE. A.Boulloud.
C.R. Acad. Sci. (Paris), Vol. 246, No. 24, 3325-8 (June 16, 1958). In French.

An inversion is used on the equivalent system of two contiguous spheres and the charge carried by the sphere is calculated using image theory. The force is deduced by considering the sum of the forces due to the external field and the image-charges on the other sphere, which is equivalent to the plane. A.E.Kay

537.221

6934. CONTACT POTENTIAL MEASUREMENTS ON GRAPHITE. A.B.Fowler.
J. appl. Phys., Vol. 29, No. 7, 1132 (July, 1958).

Oxygen contamination of graphite baked-out at 1200° C under a vacuum of the order of 10^{-6} mm Hg at this temperature was investigated. Measurements of contact p.d. were made between a clean and a "cleaner" sample. Subsequent oxygen contamination at pressures from 2×10^{-8} mm up to 10^{-6} mm Hg and further baking out suggest that the contact potential is fairly constant until the graphite is exposed to oxygen at pressures higher than in any previous exposure. C.A.Hogarth

537.222

6935. EFFECTS OF HUMIDITY ON LICHTENBERG FIGURES. B.Arai.
Sci. Rep. Yokohama Nat. Univ. I, No. 6, 21-5 (Sept., 1957).

The effect of humidity on size and shape of klydonograms is examined for positive, steep-fronted surge-voltages. Fairly consistent results are obtained for absolute humidity values up to about 20 g/m³ but, above that value, the figures tend to become irregular with individual pronounced surface streamers while the size of the figures begins either to be reduced or to be considerably increased or surface flashover begins to occur. R.H.Golde

537.222

6936. OBSERVATIONS ON STEADILY MAINTAINED BIPOLAR LICHTENBERG FIGURES. J.Dachs.
Z. angew. Phys., Vol. 9, No. 4, 158-63 (April, 1957). In German.

Lichtenberg figures were produced by firing beams of electrons (50 kV) at the surface of insulators at a residual gas pressure of 10^{-3} mm Hg. The intensity of the figures could be so increased by smearing the insulating surface with vacuum grease that external recording could be used. The Lichtenberg figures formed on various insulating surfaces are described. J.D.Craggs

537.222 : 535.39 : 621.397.3

DEFORMATION OF THIN FILMS BY ELECTRIC FIELDS. THEORY OF EIDOPHOR PROCESSES. See Abstr. 6881

537.226.08 : 621.317.336

6937. A METHOD FOR DETERMINING COMPLEX DIELECTRIC CONSTANTS AT WAVELENGTHS OF 8 TO 80 cm AND TEMPERATURES TO −150° C. H.K.Ruppersberg.
Z. angew. Phys., Vol. 9, No. 1, 9-13 (Jan., 1957). In German.

A standing-wave method of impedance measurement is described, in which the liquid sample is contained in a vertical section of coaxial line within a Dewar flask. Outstanding features of the apparatus are a short-circuit plunger immersed in the liquid and a line of very low thermal conductance which connects sample chamber and standing wave detector. The apparatus can also be used for measuring the properties of solids. K.W.Plessner

537.226.1

6938. ELECTRICAL PROPERTIES OF DIELECTRIC WITH VARIABLE NUMBER OF RELAXANTS.
N.P.Bogoroditskiĭ, Yu.M.Volokobinskiĭ and I.D.Fridberg.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 3, 487-90 (1958). In Russian.

The number of relaxants per unit volume of dielectric may vary, e.g. with temperature, or applied electric field; moreover their energy distribution may also change, becoming Maxwellian for high temperatures or strong fields. Formulae are established for dielectric constant and electric susceptibility as functions of the relaxants density and energy distribution. The transition to semiconduction is discussed. J.W.Gardner

537.226.2 : 621.315.611

6939. THE DIELECTRIC PROPERTIES OF WOOL WAX AND SOME DERIVATIVES. J.S.Cook, J.S.Dryden and R.J.Meakins.
Austral. J. appl. Sci., Vol. 7, No. 4, 371-8 (Dec., 1956).

The dielectric properties of wool wax, and certain derivatives, were measured in the frequency range from 5 c/s to 9 Gc/s. By simple purification of wool wax, a material with a relative permittivity of 3.2 and low dielectric loss at power and audio frequencies can be obtained. Some of the wool-wax derivatives also have low dielectric loss at power frequencies and slightly higher permittivities than the wool wax itself. A.

537.226.2 : 538.221

6940. ON THE ELECTRIC AND MAGNETIC SPECTRA OF γ-Fe_2O_3. J.C.Bluet, I.Epelboin and D.Quivy.
C.R. Acad. Sci. (Paris), Vol. 246, No. 2, 246-9 (Jan. 13, 1958). In French.

Measurements were made of the dielectric permittivity and magnetic permeability of compressed powders of γ-Fe_2O_3 over the frequency range from 10 kc/s to 23 Gc/s. The constants for the material were deduced from those of the powders by the logarithmic mixture law, which was proved to hold over the range from 12% to 42% Fe_2O_3. The magnetic data appears to agree within experimental error with previous measurements by Birks (Abstr. 368/1948). L.E.Cross

537.226.2

6941. THE DIELECTRIC BEHAVIOUR OF HEXAGONAL SELENIUM IN THE 10 cm WAVELENGTH REGION.
J.Jaumann and E.Neckenbürger.
Z. Phys., Vol. 151, No. 1, 72-92 (1958). In German.

Both the dielectric constant and the specific electrical resistance of polycrystalline hexagonal selenium are found to decrease in the frequency range from 300 to 4300 Mc/s. Whilst there is no evidence of a frequency-independent limiting value for the electrical resistance, the dielectric constant tends towards an asymptotic value of 8 in the neighbourhood of 5000 Mc/s. These h.f. measurements on specimens, which had been heat treated for various periods or aged under a variety of conditions, reveal a correlation between their electrical resistance on the one hand and their dielectric constant and loss factor on the other. Thus, the view finds support that polycrystalline selenium is a heterogeneous system consisting of at least two phases, a matrix of hexagonal crystallites embedded in a quasi-amorphous mass of comparatively poor conductivity. R.Schnurmann

537.226.2

6942. THE EFFECT OF AN ADMIXTURE OF IODINE ON THE DIELECTRIC CONSTANT OF AMORPHOUS SELENIUM.
B.V.Bersenev.
Zh. tekh. Fiz., Vol. 28, No. 5, 1054-5 (1958). In Russian.

Studies of selenium with concentrations of iodine varying between 0 and 5% show that the dielectric constant and tan δ increase with increasing iodine concentration, but resistivity decreases. The effect of addition of iodine on dielectric constant is greater at 50 c/s than at 300-700 kc/s. Z.Krasucki

537.226.2 : 537.529

DIRECTIONAL ELECTRIC BREAKDOWN OF KCl.
See Abstr. 5943

537.226.2

6943. AFTER EFFECT OF THE DOMAIN MOTION IN ROCHELLE SALT CRYSTAL. T.Nakamura.
J. Phys. Soc. Japan, Vol. 12, No. 5, 477-82 (May, 1957).

The after effect was observed for several hours. The quasi-static f–E hysteresis loop was obtained, where f is the fraction of the domain saturated in one direction to the total volume of the crystal. Comparing this with the P–E hysteresis loop at 50 c/s, differences are considerable. The a.c. hysteresis loop has shallow sloping sides and high coercivity, while the quasi-static f–E hysteresis loop is almost square and shows much lower coercivity; f is time dependent and can be expressed in the formula: $f(t) = 1 - e^{-\alpha t}$ where the time constant $1/\alpha$ is about one hour for a critical field about 60 V/cm, in a sample of thickness 0.6 mm at 10° C. A.

537.226.2

6944. ON THE 180°-TYPE DOMAIN WALL OF $BaTiO_3$ CRYSTAL.
W.Kinase and H.Takahasi.
J. Phys. Soc. Japan, Vol. 12, No. 5, 464-76 (May, 1957).

The energy of the 180°-type domain wall of $BaTiO_3$ crystal is obtained as 1.4 erg/cm^2 considering the dipole interaction and interatomic energy to be of Born type. The dipole interaction term is obtained approximately from the difference of the energy of ferroelectric and antiferroelectric dipole configurations. The wall is found to be quite thin, that is, the change of polarization at the boundary is abrupt, in contrast with the ferromagnetic walls. The structure of the 180° domains and the reversing process are also discussed. A.

537.226.2

6945. ELECTRON SPIN RESONANCE IN SINGLE CRYSTALS OF $BaTiO_3$. W.Low and D.Shaltiel.
Phys. Rev. Letters, Vol. 1, No. 2, 51-2 (July 15, 1958).

Results of measurements on thin crystal plates in the tetragonal ferroelectric phase are reported for different crystal orientations. Four strong lines were observed whose intensity varied markedly as the ratio of the magnitude of a to c domains was varied. The authors believe the spectra to be connected with the ferroelectric state of $BaTiO_3$ and not with any paramagnetic impurity, as in the work of Hornig, Jaynes, and Weaver (Abstr. 2006/1955). A.J.Manuel

537.226.2

6946. THE PERMITTIVITY OF BARIUM TITANATE AT 10 Gc/s.
H.J.Schmitt.
Z. angew. Phys., Vol. 9, No. 3, 107-11 (March, 1957). In German.

Measurements were made on ceramic samples of different densities between room temperature and 160°C. The ratio of high-frequency to low-frequency permittivity was nearly the same for the different materials and did not vary up to the Curie point, above which it gradually approached unity. A superimposed d.c. field caused the high-frequency permittivity to change very little compared with the pronounced decrease produced in the low-frequency value. K.W.Plessner

537.226.31

6947. NEUTRALIZING EFFECT IN SILICATE GLASSES.
G.I.Skanavi and A.I.Demeshina.
Zh. tekh. Fiz., Vol. 28, No. 4, 748-54 (1958). In Russian.

Dielectric losses and permittivity of glasses of the three-component system SiO_2–Na_2O–K_2O were investigated at different frequencies (1 kc/s and 3.1 Mc/s) and at temperatures from −160° to +230°C. It was found that the neutralizing effect exists not only for tan δ but also for the permittivity, i.e. not only tan δ but also the permittivity decreases when one alkali oxide is partly replaced by another. Z.Krasucki

537.226.31 : 539.217

6948. DIELECTRIC LOSSES IN CRYSTAL HYDRATES AND THEIR RELATION TO DIFFUSION PHENOMENA. I.Ts.Lyast.
Zh. tekh. Fiz., Vol. 28, No. 4, 827-31 (1958). In Russian.

The relaxation time (τ) of dielectric losses in crystal hydrates is determined by the rate of diffusion of water of crystallization. Calculations of τ were made using the mechanism of relaxation polarization put forward in Abstr. 2179 (1957). The derived expressions are compared with experiment using some published data on gypsum. Z.Krasucki

537.226.33

6949. DIELECTRIC RELAXATION IN CaF_2 SINGLE CRYSTALS.
G.Jacobs.
J. chem. Phys., Vol. 27, No. 6, 1441-2 (Dec., 1957).

The difference observed in the dielectric relaxation of two separate batches of CaF_2 crystals is attributed to impurities such as Al or oxygen. G.I.W.Llewelyn

ELECTRIC CONDUCTION. CURRENTS

537.311.3 : 536.424.1

6950. ELECTRICAL PROPERTIES AND STRUCTURE OF THE INTERMEDIATE FORMS OF CARBON.
V.I.Kasatochkin and A.T.Kaverov.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 5, 1007-10 (1958). In Russian.

Petroleum coke powders and two varieties of lamp black were heat-treated isothermally in an atmosphere of N at temperatures ranging from 1000 to 3000°C, and the effect of time and temperature of the treatment on the structure (the interlayer spacing), thermo-e.m.f. and electrical resistivity of these substances was investigated. The results are taken to indicate that the allotropic forms of carbon, intermediate between the "amorphous" and graphitic modifications, are characterized by both p- and n-type conductivity, the latter becoming more predominant with the increasing degree of graphitization as indicated by decreased interlayer spacing. M.H.Sloboda

537.311.31 : 539.234

6951. DEVELOPMENT [IN TIME] OF THE ELECTRICAL RESISTANCE OF THIN FILMS OF COBALT. F.Savornin.
C.R. Acad. Sci. (Paris), Vol. 246, No. 15, 2230-3 (April 14, 1958). In French.

The films were deposited in vacuo on plane glass plates and maintained in vacuo at either ambient temperature (16–22° C), or at 175 ± 5° C, while their electrical resistance was measured from immediately after deposit until several hours later. The results, shown graphically, show that the time variation is markedly different in the two cases, but all the films studied (2 to 21 mμ thick) have finally a positive resistance temperature coefficient, even if originally they had the characteristics of granular films.

S.Weintroub

537.311.31 : 539.4.016

6952. RECOVERY OF ELECTRICAL RESISTIVITY OF Cu, Au, AND Ni FOLLOWING COLD WORK AT 4° K.
C.J.Meechan and A.Sosin.
J. appl. Phys., Vol. 29, No. 4, 738-9 (April, 1958).

The results show that no rapid recovery occurs between 4° and 8° K, in contrast with the recovery behaviour of these metals at 30° K after irradiation by either electrons, deuterons or neutrons (except deuteron irradiated Au). Only about 2% recovery of the resistivity was observed, varying slightly with the degree of cold work. It is inferred that the mobile defects responsible for the rapid recovery in irradiated metals are not created to any appreciable extent by cold work. The nature of the "continuum" recovery is also discussed. A.E.Kay

537.311.31

6953. THEORY OF THE ELECTRICAL RESISTANCE OF ORDERED ALLOYS OF TRANSITION WITH NON-TRANSITION METALS. Z.A.Matysina and A.A.Smȳrnov.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 14-20 (1957). In Ukrainian.

An attempt is made to determine the variation, with composition and degree of long-range order, of the residual electrical resistance of alloys of transition with non-transition metals, which can occur in disordered and ordered states. Zero-approximation wave-functions were chosen as superposition functions for the s- and d-states. It was found that the residual electrical resistance of the alloys is not explicable by s–d transitions, but is associated with the peculiar type of curve of dependence of the density of conductivity electron states upon energy. There is qualitative agreement of theory and experiment for Pd–Cu, Pd–Ag and Pd–Au alloys.

C.R.S.Manders

537.311.31

6954. THE THEORY OF THE ELECTRICAL RESISTANCE OF ALLOYS. A SURVEY . A.A.Smȳrnov.
Ukrayin. fiz. Zh., Vol. 2, No. 3, 211-25 (1957). In Ukrainian.

537.311.31 : 539.371

6955. THE EFFECT OF ELASTIC DEFORMATIONS ON THE ELECTRICAL CONDUCTIVITY OF MONOVALENT METALS AT HIGH TEMPERATURES. R.I.Kovtun.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 30-42 (1957). In Ukrainian.

Using Bloch's equation and applying a perturbation method the effect of elastic strain upon the electrical conductivity of monovalent metals is calculated. Results for polycrystalline metals are obtained by averaging over all orientations of a single crystal. The free-electron model is not found to explain the increase of resistance with strain; rather it gives an opposite sign to the change. The theory of bound electrons gives values of correct sign and order for change of resistance with strain. Variations of effective mass are shown to be the main cause of conductivity v. strain variation.

C.R.S.Manders

537.311.31 : 538.632

6956. TEMPERATURE ANOMALY OF RESISTANCE AND THE HALL EFFECT IN GOLD. Yu.P.Gaidukov.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 836-42 (1958). In Russian.

The Hall effect in gold samples possessing normal and abnormal temperature dependences of the resistance was studied at various temperatures and magnetic field values. A jump was observed in the Hall constant of an "anomalous" sample in a field of 8 kOe. The magnitude of the jump increased with decrease of temperature. A field strength of 8 kOe is the value at which the anomalous temperature dependence of the resistance vanishes. A.

537.311.31 : 536.212.2

6957. THE DETERMINATION OF THE LORENZ NUMBER AT HIGH TEMPERATURES. M.R.Hopkins and R.L.Griffith.
Z. Phys., Vol. 150, No. 3, 325-31 (1958).

In a conducting system consisting of a short fine wire carrying a current between two large masses of the same metal, the maximum temperature attained depends only upon the properties of the material and the applied potential difference, provided the heat lost from the surface of the wire is negligible compared with that conducted. Measurement of the maximum temperature as a function of the potential difference allows the ratio of the thermal conductivity λ to the electrical conductivity κ, and hence the Lorenz number $\lambda/\kappa T$, where T is the absolute temperature, to be determined over a wide range of temperature. Experiments with platinum in various gases at atmospheric pressure and also at low gas pressures to test the effect of heat losses due to the surrounding gas are described. Under the conditions of the experiments, these losses are very small except in the case of hydrogen, the results agreeing among themselves and with those previously published. Values of the Lorenz number for palladium from 1000° to 1550° C are given. A.

537.311.31 : 538.63 : 539.234

6958. THE DEPENDENCE OF MAGNETORESISTANCE CHANGES IN EVAPORATED NICKEL FILMS ON THICKNESS AND STRUCTURE. W.Hellenthal.
Z. Phys., Vol. 151, No. 4, 421-30 (1958). In German.

Magnetoresistance measurements on evaporated nickel films between 40 A and 600 A thick, condensed on glass surfaces at temperatures between 20°C and 400°C, show a decrease in the difference between the longitudinal and transverse magnetoresistance effects with decrease of film thickness. An expression for calculating the spontaneous magnetization of the nickel in the films from the measurements is derived. The spontaneous magnetization so calculated decreases with decreasing film thickness in agreement with the theory of Klein and Smith (Abstr. 4528/1951) as modified by Drigo (Abstr. 408/1952). The derived values of spontaneous magnetization agree, within the limits of experimental error, with the direct measurements of other workers. A.J.Manuel

537.311.31

6959. CONCERNING THE INFLUENCE OF SHORT-RANGE ORDER ON THE TYPE OF CONDUCTIVITY.
V.L.Zyazev and O.A.Esin.
Zh. tekh. Fiz., Vol. 28, No. 1, 18-22 (1958). In Russian.

The electrical conductivities, σ, of binary alloys of various compositions of V_2O_5 with PbO, MgO and CaO were measured from 550–1200° C. For high V_2O_5 contents the temperature dependence of σ indicated semiconduction; at V_2O_5 contents lower than those corresponding to $V_2O_5.2PbO$, $2V_2O_5.3MgO$, or $V_2O_5.CaO$, the values of σ and their temperature dependences were characteristic of ionic conductors. K.F.Hulme

537.311.31

6960. TEMPERATURE DEPENDENCE OF THE RESISTIVITY OF ZINC, CADMIUM AND ANTIMONY ABOVE THEIR BOILING POINTS. A.R.Regel'.
Zh. tekh. Fiz., Vol. 28, No. 3, 521-4 (1958). In Russian.

In contrast to the metals of Group I, the temperature coefficient of resistivity of the fused metals of Group II is very small. To check the hypothesis that, starting from a sufficiently high temperature, the resistivity ρ of these elements should rapidly increase, the author studied the variation of ρ of Zn, Cd and Sb at temperatures up to 1300° C. The experimental samples were contained in evacuated quartz ampoules, and the measurements were carried out by the rotating magnetic field method. The results reproduced graphically show that, although the temperature range of low temperature coefficient of resistance is quite extensive for both Cd and Zn, ρ for these metals starts to increase very rapidly at 800° and 1000° C, respectively, the variation of ρ of Sb being of a similar character. It is postulated that the observed anomalies are associated with the effect of heating on the free electron concentration, short-range order and anisotropy of the investigated metals. M.H.Sloboda

537.311.31 : 539.234

6961. THE ELECTRICAL PROPERTIES OF THIN FILMS OF IRON, NICKEL, AND COBALT. N.I.Ginzburg and A.M.Polyakov.
Zh. tekh. Fiz., Vol. 28, No. 5, 1029-31 (1958). In Russian.

Precautions were taken during the preparation (by evaporation in vacuum) and storage of the films to minimize contamination or oxidation. Measurements made on Co films during deposition showed that only after the thickness 8×10^{-6} g/cm^3 had been attained did the resistance R of the films vary inversely as the deposition time, although no induction period before R became finite was found (indicating that Co atoms were not mobile on the glass substrates at 300° K). Measurements of R were made for various thicknesses and temperatures (1.65°–300° K). For $R_{300} < 10^4$ ohm, R decreased on cooling,

whereas for $R_{300} > 10^4$ ohm, R increased (the film dimensions were not given, but the areas appeared to be $\sim 2 \times 10$ mm^2); in previous work only increases have been found. There was no evidence of the superconductivity of thin ferromagnetic films previously postulated by Ginzburg (Abstr. 2259/1957). K.F.Hulme

537.311.31 : 538.221

THIN FERROMAGNETIC FILMS. ELECTRICAL PROPERTIES OF THIN NICKEL FILMS. See Abstr. 6046

537.311.32

6962. ON THE ELECTRICAL CONDUCTIVITY OF LEAD(II)-OXIDE WITH ADDITIONS OF K_2O. H.Grunewald and J.Feldmann. Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 183-4 (1958). In German.

Measurements over the range from 200° to 500° C show that small (< 0.3 molar %) additions of K_2O increase the conductivity of PbO, but that further additions up to 2 molar % cause no further change. The usual model of structural disorder and an equivalent number of holes must therefore be modified in these conditions. A.H.W.Beck

537.311.32

6963. ON THE ELECTRICAL CONDUCTIVITY OF LEAD(II)-OXIDE WITH ADDITIONS OF Cr_2O_3. H.Grunewald and W.Neumann. Z. angew. Phys., Vol. 9, No. 9, 447-8 (Sept., 1957). In German.

Measurements over the range from 200° to 500° C show insignificant changes in the conductivity for concentrations up to 1.0 molar % of Cr_2O_3 (see preceding abstract). Possible structural reactions are discussed. A.H.W.Beck

537.311.32

6964. SURFACE CONDUCTIVITY OF QUARTZ IN THE PRESENCE OF ADSORBED LAYERS.
I.F.Abdrakhmanova and B.V.Deryagin.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 1, 94-7 (1958). In Russian.

When transparent quartz specimens, previously annealed at white heat or subjected to glow discharge so as to have their surface conductivity reduced to $< 10^{-17}$ ohm^{-1}, were exposed to vapours of different relative pressures (in relation to saturation pressures), it was found that (1) water and alcohol (from ethyl to octyl) vapours caused a rise of conductivity (in the case of H_2O and C_2H_5OH up to about 10^{-11} ohm^{-1}), the values decreasing with the increasing molecular weight of the alcohols; (2) no conductivity increase was caused by vapours of CCl_4 or C_6H_6; and (3) in the case of H_2O and alcohols a certain kinetic process was found to take place as regards surface conductivity when these substances were adsorbed by transparent quartz: the conductivity first rose rapidly to a peak value several times greater than equilibrium conductivity, after which the equilibrium value was gradually reached. F.Lachman

537.311.32 : 535.343

CONDUCTIVITY OF ZnO. See Abstr. 6847

537.311.33 : 621.382

6965. RECOMBINATION IN TRAPS AT TWO LEVELS IN SEMICONDUCTORS. M.Bernard.
C. Electronics and Control, Vol. 5, No. 1, 15-18 (July, 1958). In French.

The derivation is given of the recombination statistics of excess carriers in semiconductors through a Hall–Shockley–Read mechanism with two non-independent levels in the forbidden gap. Two examples are outlined: low-level injection lifetime and generation rate for p-n junction charge space. A.

537.311.33

6966. EFFECT OF NEUTRAL IMPURITIES ON MOBILITY IN NONDEGENERATE SEMICONDUCTORS.
M.S.Sodha and P.C.Eastman.
Phys. Rev., Vol. 108, No. 6, 1373-5 (Dec. 15, 1957).

The variation of mobility with electric field is investigated, taking the scattering by lattice vibrations and impurities (both ionized and neutral) into account. A study of the variation of zero-field mobility of a sample with temperature can lead to a knowledge of the variation of the zero-field ionized-impurity mobility or neutral-impurity mobility with temperature, which might be checked with theory. This study is confined to the case of low temperatures and high impurity concentrations, for which Sclar's theory of ionized impurity scattering (Abstr. 3257/1957) is valid. A.

537.311.33

6967. MOBILITY OF CARRIERS IN NONDEGENERATE SEMICONDUCTORS AT LOW ELECTRIC FIELDS. M.S.Sodha.
Phys. Rev., Vol. 108, No. 6, 1375-6 (Dec. 15, 1957).

By using the velocity distribution of carriers in the presence of an electric field E, due to Yamashita and Watanabe, it is shown that the mobility μ is given by $\mu = \mu_0(1 + \beta E^2)$ for low fields. The values of β obtained are larger than those arrived at by the assumption that the distribution is Maxwellian in the presence of an electric field. The discrepancy between the theoretical and observed values of β is large enough to justify further careful examination of the theory of the perturbing effect of weak fields. A.

537.311.33

6968. PROPOSAL FOR DETECTION OF NEGATIVE-MASS CARRIERS BY CYCLOTRON RESONANCE. G.C.Dousmanis.
Phys. Rev. Letters, Vol. 1, No. 2, 55-6 (July 15, 1958).

About 3% of the heavy holes in Ge and Si have negative transverse effective masses (c.f. Krömer, Abstr. 4167/1958). It is suggested that these should be detectable by cyclotron resonance experiments. R.G.Chambers

537.311.33

6969. OBSERVATION OF MICROWAVE CYCLOTRON RESONANCE BY CROSS MODULATION.
H.J.Zeiger, C.J.Rauch and M.E.Behrndt.
Phys. Rev. Letters, Vol. 1, No. 2, 59-60 (July 15, 1958).

It is found that the d.c. resistance of a sample of Ge or InSb is altered at resonance, because of the heating of the carriers by the microwave power. A spontaneous d.c. voltage may also appear across the sample at resonance. The signal-to-noise ratio for this effect appears to be better than for the conventional method of resonance detection. R.G.Chambers

537.311.33

6970. CONTRIBUTION TO THE THEORY OF A PHOTOELECTRIC METHOD OF DETERMINING THE LIFETIME OF SUPERFICIAL CURRENT CARRIERS IN SEMICONDUCTORS.
E.I.Rashba and K.B.Tolpygo.
Ukrayin. fiz. Zh., Vol. 1, No. 1, 29-43 (1956). In Ukrainian, with summary (2½ pp.) in Russian.

The theoretical aspects of the method put forward by Valdes (Abstr. 844/1953) are considered at some length. Four further topics discussed are: the unidimensional case, the axial-symmetrical case, the effect of surface recombination upon the diffusion of carriers, the measurement of carrier lifetimes. C.R.S.Manders

537.311.33

6971. THE PHOTOELECTRIC METHOD OF MEASURING THE DIFFUSION DISPLACEMENT LENGTH OF SURFACE CURRENT CARRIERS IN SEMICONDUCTORS. K.D.Heynchuk and O.H.Miselyuk.
Ukrayin. fiz. Zh., Vol. 1, No. 1, 44-58 (1956). In Ukrainian, with summary (4½ pp.) in Russian.

Gives the results of measurements on surface current carriers in Ge. In the course of the experiments it was shown that the ignoring of certain factors could lead to considerable error in the determination of the diffusion length, e.g. the recombination of photo-injected surface current carriers in the semiconductor or insufficiently strict account being taken of the geometrical criteria of applicability of the unidimensional and axial-symmetrical approximations. This is discussed at length; also the lux–volt characteristic of a collector contact and the measurement of $L_{Diff.}$ by a constant photo-response method. C.R.S.Manders

537.311.33 : 537.312.5

6972. THE KINETICS OF THE BIPOLAR PHOTO-E.M.F. IN A SEMICONDUCTOR WITH METALLIC ELECTRODES.
O.I.Kaplunova and K.B.Tolpygo.
Ukrayin. fiz. Zh., Vol. 1, No. 4, 347-65 (1956). In Ukrainian, with summary (2½ pp.) in Russian.

An experimental study of the kinetics of the photo-e.m.f. in Cu_2O illuminated with a rectangular light-pulse exhibits peculiarities in the photo-e.m.f. Lashkarev has suggested that non-rectangularity of the photo-e.m.f. may be accounted for by a superposed negative voltage arising at the junction of the electrode and semiconductor which takes time to achieve equilibrium. The present paper is a theoretical development of this theory assuming no non-linear effects. The authors consider that the theory as developed by them, together with Potapenko's experimental work (Thesis, Kiev, 1951), provide support for an exciton mechanism of the internal photoeffect in Cu_2O. C.R.S.Manders

537.311.33

6973. CHANGE OF RESISTANCE IN POLAR-MODEL SEMICONDUCTORS IN A MAGNETIC FIELD. O.M.Muzychuk.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 43-52 (1957). In Ukrainian, with summaries (½ p.) in Russian and (½ p.) in English.

The intrinsic semiconductor magnetoresistance is calculated, together with the energy spectrum of the excited system unperturbed

by lattice thermal-vibrations. For weak fields a second-degree variation of magnetoresistance with field is found.

C.R.S.Manders

537.311.33

6974. ON THE QUESTION OF THE DIFFERENCE BETWEEN RECOMBINATION CENTRES AND TRAPPING LEVELS. V.L.Bonch-Bruevich.
Zh. tekh. Fiz., Vol. 28, No. 1, 67-9 (1958). In Russian.

It is pointed out that the same energy level in the forbidden gap of a semiconductor may act as a recombination centre or trapping level, depending on the conditions. The 0.32 eV level of Cu in Ge could act as a trapping level below 130°K. K.F.Hulme

537.311.33 : 517.9

6975. THEORY OF THE P–N JUNCTIONS IN SEMICONDUCTORS. B.M.Vul and B.I.Segal.
Zh. tekh. Fiz., Vol. 28, No. 4, 681-8 (1958). In Russian.

The potential distribution in a p–n junction in the absence of an external potential is described by a differential equation, $d^2u/dx^2 - \sinh(u) = -f(x)$, derived by Shockley (Bell Syst. Tech. J., Vol. 28, 435-89, 1949). The authors obtain an approximate solution of this equation for the case when $\sinh(u) = u$ and $x = \pm\infty$, and determine the criteria of applicability of their linear approximation for obtaining an accurate solution of the original equation.

M.H.Sloboda

532.311.33

6976. MOBILITY OF THE MINORITY CURRENT CARRIERS IN COLLINEAR ELECTRICAL AND MAGNETIC FIELDS. P.I.Baranskiĭ.
Zh. tekh. Fiz., Vol. 28, No. 4, 694-703 (1958). In Russian.

Using the null-method of detection at a point collector (Abstr. 9186/1957), the drift mobility (u) of the minority current carriers in a constant electric field (2 V/cm) was measured in 10 ohm cm, n-type Ge maintained at a constant mean temperature (20.8°C), with the temperature gradient dT/dx varying between −15.4 and +15.4 (deg C)/cm. Since under these conditions u was not affected by the variation of dT/dx, the author concludes that at room temperature no drag on the charge carriers is exerted by phonons moving from hot to cold regions in thermal conduction, and that the drag effect cannot explain the fact that in the extrinsic range $P \neq \alpha T$ (where P is the Peltier coefficient, α the thermo-e.m.f., and T the absolute temperature). It is pointed out that since no evidence of interaction between phonons and current carriers was found, the null method of measuring u can be applied at room temperature even in the presence of a temperature gradient. M.H.Sloboda

537.311.33

6977. HIGH [ELECTRIC] FIELDS IN THE THEORY OF THE ELECTRICAL CONDUCTIVITY OF SEMICONDUCTORS. N.V.Fomin.
Zh. tekh. Fiz., Vol. 28, No. 4, 783-6 (1958). In Russian.

Limits of applicability of the standard formulae for calculating the mobility of the charge carriers in p-type Si are determined. At low temperatures, deviation from the Bardeen–Shockley formula can be expected at comparatively low electric fields (10 V/cm). The Conwell–Weisskopf formula is more reliable at high impurity concentrations. M.H.Sloboda

537.311.33

6978. ON THE VARIATION OF IONIZATION ENERGY IN IMPURITY SEMICONDUCTORS. M.L.Chetkarov.
Zh. tekh. Fiz., Vol. 28, No. 5, 962-4 (1958). In Russian.

The variation of ionization energy with impurity concentration is calculated on a simple model for weak and strong electric fields, assuming that the impurity atoms are situated at the corners of a simple cubic "superlattice"; the predicted variation agrees with data for Si and Ge quoted in the literature (obtained from Hall constant and conductivity measurements). Expressions are also given for the electrical conductivity. K.F.Hulme

537.311.33

6979. ON THE THEORY OF THE PHOTOELECTROMAGNETIC EFFECT IN SEMICONDUCTORS. G.M.Guro.
Zh. tekh. Fiz., Vol. 28, No. 5, 1036-45 (1958). In Russian.

Expressions are derived for the longitudinal and transverse P.E.M. voltages for rectangular specimens weakly illuminated in small magnetic fields. It is shown that the lifetime of non-equilibrium carriers ($< 10^{-6}$ sec) can be determined directly by measuring the transverse P.E.M. voltages at the illuminated and dark sides of the specimen. The conditions for the applicability of the usual approximate formulae (derived for a semi-infinite specimen) are found, e.g. if lifetimes $< 10^{-6}$ sec are to be measured to within 20% accuracy the ratio of specimen length to thickness must be > 30. It is shown that the circulating currents provide a term in the longitudinal P.E.M. voltage linearly dependent on the magnetic field as well as the already known quadratically dependent term.(Abstr. 340/1956). K.F.Hulme

537.311.33

6980. ON THE APPLICABILITY OF THE METHOD OF MEASURING THE SPEED OF SURFACE RECOMBINATION BY THE CHANGE OF SEMICONDUCTOR RESISTANCE IN A MAGNETIC FIELD. A.V.Rzhanov, I.A.Arkhipova and V.N.Bidulya.
Zh. tekh. Fiz., Vol. 28, No. 5, 1051-2 (1958). In Russian.

The values of the differences, ΔS, in surface recombination velocity on opposite faces of a thin plate of semiconductor measured by the magnetoresistance method proposed by Zhuze et al. (ibid., Vol. 27, 1167-73, 1957) were compared with values obtained by a bridge measurement of the effective lifetime. Agreement was obtained when ΔS was caused by changing the number of surface recombination centres per cm^2 (by light grinding); but when ΔS was caused by altering the surface electrostatic potential (by a transverse d.c. electric field) the magnetoresistance values of ΔS were ~ 6 times higher than the bridge values; no explanation is suggested. K.F.Hulme

537.311.33 : 539.2

6981. CORRECTION TO THE PAPER "ON THE STRUCTURE OF ELECTRON SPECTRA IN TELLURIUM-TYPE LATTICES". Yu.A.Firsov.
Zh. éksper, teor. Fiz., Vol. 34, No. 1, 240-2 (1958). In Russian.

Correction to Abstr. 2328 (1958).

537.311.33 : 537.32

6982. THE ELECTRICAL CONDUCTIVITY AND THERMO-ELECTRIC POWER OF THE SILICIDES OF THE TRANSITION METALS. E.N.Nikitin.
Zh. tekh. Fiz., Vol. 28, No. 1, 26-8 (1958). In Russian.

With a view to their use in thermoelectric generators, the thermoelectric powers, α, and electrical conductivities, σ, of 23 silicides were measured. The method of specimen preparation is described; for each silicide two separate syntheses were made using Si of 99.999% and 99.03% purity. The results are tabulated; the effects of introducing impurities of Co, Ni and B into $MnSi_\gamma$ and of B into $CrSi_2$ are described. Measurements of the thermal conductivities of $MnSi_\gamma$ and $CrSi_2$ suggest that, with 800° C temperature difference between hot and cold junctions, the efficiency of thermoelectric generation should be ~ 5% for these two silicides. K.F.Hulme

537.311.33 : 53[illegible].22

6983. RESISTIVITY AND DENSITY OF POLYCRYSTALLINE YTTRIUM IRON GARNET. L.G.Van Uitert and F.W.Swanekamp.
J. appl. Phys., Vol. 28, No. 12, 1513-14 (Dec., 1957).

High density is produced either by initial high temperature reaction or by the addition of about 4% Cu and V; the resistivity also depends on the method of preparation. E.P.Wohlfart

537.311.33 : 538.63

6984. THE MEASUREMENTS OF THE GALVANOMAGNETIC TENSORS OF BISMUTH. T.Okada.
J. Phys. Soc. Japan, Vol. 12, No. 12, 1327-37 (Dec., 1957).

The anisotropy of the galvanomagnetic effects in the single crystals of pure bismuth was investigated at the temperatures between −160° and 45°C. The results were analysed by the phenomenological theory of the galvanomagnetic effects. Two components of the resistivity tensor, two components of the Hall tensor, eight components of the magneto-resistance tensor and six components of the third-order galvanomagnetic tensor were determined as functions of temperature.

537.311.3

6985. LIFETIME MEASUREMENTS OF MINORITY CARRIERS IN DEUTERON IRRADIATED GERMANIUM CRYSTALS. R.R.Hasiguti, E.Matsuura and S.Ishino.
J. Phys. Soc. Japan, Vol. 12, No. 12, 1351-4 (Dec., 1957).

Measurements were made on the surfaces of n-type germanium crystals. Fictitiously long lifetimes were obtained, which suggest the formation of a p-type thin layer by the deuteron irradiation. Etch figures were observed on the irradiated surfaces.

537.311.3

6986. PREDICTED INTERVALLEY SCATTERING EFFECTS IN GERMANIUM. W.Shockley.
Phys. Rev., Vol. 110, No. 5, 1207-8 (June 1, 1958).

Experiments are suggested which involve the injection of electrons in specially orientated n-p junctions and n-p-n transistors at a.c. frequencies of the order of the inverse relaxation time for

intervalley scattering. The eccentricity of the ellipsoidal energy surfaces in the conduction band can be deduced. R.Stratton

537.311.33

6987. CHANGE OF ELECTRICAL CONDUCTIVITY OF GERMANIUM UNDER THE INFLUENCE OF AN EXTERNAL ELECTRIC FIELD. V.I.Lyashenko and R.O.Litvinov.
Ukrayin. fiz. Zh., Vol. 1, No. 2, 143-50 (1956). In Ukrainian, with summary (1 p.) in Russian.

A high resistance single crystal of germanium in the form of a plate was used as one plate of a condenser, the other plate being a metal sheet. Charging the condenser subjects the Ge crystal to an external field. Switching on p.d. across the condenser causes a sharp change in the resistance of the specimen, the change does not remain constant but decreases with time towards some definite value. Current through the specimen follows a Becquerel law $I = I_0/(1+at)^{\alpha}$, where a and α are different for different specimens. With a positive potential on the metal plate the conductivity of the Ge rises, with reversed field the conductivity falls. A ground-off specimen was also studied at low temperatures. The mechanism of the effects observed is considered to be considerably more complex than suggested by Low (Abstr. 1822/1955). C.R.S.Manders

537.311.33 : 537.572

6988. COLLISION IONIZATION IN GERMANIUM P—N JUNCTIONS. A.P.Shotov.
Zh. tekh. Fiz., Vol. 28, No. 3, 437-46 (1958). In Russian.

The avalanche-current increase and breakdown in germanium junctions are mathematically analysed starting from the assumption that in germanium $\beta(E) = k\alpha(E)$, where $\beta(E)$ and $\alpha(E)$ are the ionization coefficients of holes and electrons, respectively. This assumption was verified experimentally and it was shown that $k = 2$. From the experimental data on the current carriers multiplication and the breakdown voltage, the ionization coefficients and their dependence on the field potential were determined for both "step" and "linear" junctions. M.H.Sloboda

537.311.33

6989. EFFECT OF ADSORBED MOLECULES ON THE WORK FUNCTION AND CONDUCTIVITY OF GERMANIUM. I.
V.I.Lyashenko and V.G.Litovchenko.
Zh. tekh. Fiz., Vol. 28, No. 3, 447-53 (1958). In Russian.

To examine the effect of adsorbed molecules (both dipolar and non-polar) on the work function φ and resistance R of thin, single crystals of n- and p-type Ge ($\rho \cong 7$-55 ohm cm), the variation of these characteristics in ethyl alcohol, acetone, CO, benzene, O_2, CO_2 and dry and moist air was studied. In all the investigated media, except O_2, a decrease of φ was observed in both types of Ge. The resistance increased in n-type and decreased in p-type Ge. The higher the pressure P of the gas employed the larger were the total variations of φ and R. On the other hand, $\Delta R/\Delta p$ and $\Delta\varphi/\Delta p$, large in the low P range, decreased with increasing P. At constant P, $\Delta\varphi$ decreased with rising temperature. The effect of the adsorbed molecules on the surface potential (calculated from the experimental values of φ and R) is also discussed.

M.H.Sloboda

537.311.33

6990. EFFECT OF ADSORBED MOLECULES ON THE WORK FUNCTION AND CONDUCTIVITY OF GERMANIUM. II. KINETICS OF THE PROCESS. V.I.Lyashenko and V.G.Litovchenko.
Zh. tekh. Fiz., Vol. 28, No. 3, 454-9 (1958). In Russian.

Although the work function φ and the resistance R of semiconducting oxides (Cu_2O, CdO) and Ge is affected by the adsorption of gas molecules, the time required for φ and R to reach a constant value is much longer in the latter than in the former case. Using the Ge specimens and gaseous media employed in the first part of their investigation (see preceding abstract), the authors studied the time dependence of the variation of φ and R of Ge due to the adsorption of both dipolar and non-polar molecules under various conditions of pressure, temperature and surface preparation of the Ge test pieces. From the graphs

$$\log(1 - \Delta\varphi/\Delta\varphi_0) = f(t),$$

where t is the time, the specific time τ of the process was determined and its variation with pressure and temperature examined. The experimental results are taken to indicate that the observed time effects are associated with the passage of electrons through a barrier of a very thin surface oxide film the existence of which (not verified by the electron diffraction measurements) was inferred from the high value of the surface potential of the experimental Ge specimens. M.H.Sloboda

537.311.33

6991. GENERATION OF AN OSCILLATING CURRENT IN GERMANIUM SPECIMENS PLACED IN ELECTRIC AND LONGITUDINAL MAGNETIC FIELDS. Yu.L.Ivanov and S.M.Ryvkin.
Zh. tekh. Fiz., Vol. 28, No. 4, 774-5 (1958). In Russian.

When certain specimens of n-type Ge, through which a direct current I was passing, were placed in a constant magnetic field H parallel to the direction of the current, a change of the current from direct to oscillating was observed at $I_{min} \cong 1.7$ mA and $H_{min} \cong 10^4$ Oe. The oscillations were almost sinusoidal, with the frequency $f \cong 10$ kc/s, and the amplitude $U \cong 100$ mV. Both f and U were increased by increasing I and H or by lowering the ambient temperature. Strong illumination of the Ge specimens led to disappearance of the oscillations. Etching the specimens in H_2O_2 assisted in the formation of the oscillations and promoted their stability. Even a small divergence ($\alpha \cong 10^0$) between the direction of H and the axis of the specimen resulted in a decrease of U and distortion of the shape of the oscillations, which disappeared completely when α became large. M.H.Sloboda

537.311.33 : 539.234

6992. THE STRUCTURE AND ELECTRICAL PROPERTIES OF THIN LAYERS OF InSb. I.D.Konozenko and S.D.Mikhnovs'kyĭ.
Ukrayin. fiz. Zh., Vol. 1, No. 2, 151-7 (1956). In Ukrainian, with summary ($\frac{1}{2}$ p.) in Russian.

Experiments were carried out with layers of from 500 to 1000 A thickness. Layers formed by thermal sublimation were shown by electron diffraction to have a polycrystalline structure of sphalerite (ZnS) type with lattice constant a = 6.465 A. Over a temperature range -80 to 300°C (i.e. impurity conduction range) a thin layer of InSb exhibits p-type conduction whilst a single crystal shows n-type. The specific resistance of bulk material is ~ 0.1 ohm cm, whilst for thin layers it is ~ 10^2 ohm cm. The absorption spectrum of a 1000 A transparent layer is very similar over 2-15 μ range to that of a bulk specimen. C.R.S.Manders

537.311.33 : 621.315.59

6993. CARRIER MOBILITIES IN InP, GaAs, AND AlSb.
F.J.Reid and R.K.Willardson.
J. Electronics and Control, Vol. 5, No. 1, 54-61 (July, 1958).

The majority-carrier mobilities in n-type InP and GaAs and p-type AlSb were measured as functions of impurity concentration and temperature in single crystals. Considerations of scattering of the charge carriers by ionized donors and acceptors suggest lattice mobilities at 300°K of 11 500 $cm^2/(V\,sec)$ for electrons in GaAs, 6600 $cm^2/(V\,sec)$ for electrons in InP, and 450 $cm^2/(V\,sec)$ for holes in AlSb. Total ionized impurity contents can be estimated from the effects of impurity scattering on the carrier mobilities. The temperature dependencies of the electron mobility due to lattice scattering in the InP and the hole mobilities in GaAs and AlSb are greater than T^{-2}. The effective mass of the holes in AlSb is about 0.4 m_0.

A.

537.311.33 : 539.217

6994. GOLD ON SILICON SURFACES. R.O.Carlson.
J. appl. Phys., Vol. 29, No. 6, 1001-2 (June, 1958).

Heat treatment of Si crystals with a surface concentration of Au atoms was found by Bemski to reduce minority carrier lifetime and to introduce Au throughout the crystal. The author's specimens did not react in this way. A careful estimate of the surface concentration of Au was made and found to be much lower than in Bemski's crystals, so that the apparent discrepancy was resolved.

C.A.Hogarth

537.311.33

6995. THRESHOLD ENERGY FOR ELECTRON-HOLE PAIR-PRODUCTION BY ELECTRONS IN SILICON.
A.G.Chynoweth and K.G.McKay.
Phys. Rev., Vol. 108, No. 1, 29-34 (Oct. 1, 1957).

Measurements were made of the reverse bias required for the onset of multiplication in silicon p-n junctions of various width. A value of (2.25 ± 0.10) eV is arrived at for the threshold energy for electron-hole pair-production by energetic electrons. There is apparently a slight variation of the threshold energy with crystallographic direction; the directions [100], [110], [111], are listed in ascending order of threshold energies. The ionization rate for electrons is greater than for holes. The maximum phonon drag opposing the acceleration of an electron up to the threshold energy by a parabolic field distribution is equivalent to a field of 5.2×10^4 V/cm.

A.

537.311.33

6996. DOUBLE-ACCEPTOR BEHAVIOR OF ZINC IN SILICON. R.O.Carlson.
Phys. Rev., Vol. 108, No. 6, 1390-3 (Dec. 15, 1957).

Zinc has an acceptor level at 0.31 eV from the valence band as noted by Fuller and Morin (Abstr. 3283/1957). Under proper doping conditions, another level is observed at 0.55 eV from the conduction band in n-type silicon samples into which zinc has been diffused. Gold, manganese, and iron, however, have levels close to 0.55 eV. Gold is eliminated as an interfering impurity on the basis of neutron activation analysis. Manganese and iron are unlikely to be present in high enough concentrations on the basis of their electrical activity in samples deliberately doped with these elements. Mobility and radioactive solubility studies tend to confirm the hypothesis that the 0.55 eV level represents a second acceptor level associated with zinc. A.

537.311.33

6997. CONDUCTIVITY MOBILITIES OF ELECTRONS AND HOLES IN HEAVILY DOPED SILICON. G.Backenstoss.
Phys. Rev., Vol. 108, No. 6, 1416-19 (Dec. 15, 1958).

Electron and hole mobilities in silicon were determined in a region in which ionized impurity scattering is predominant. Resistivities were measured by a four point probe and impurity concentrations were obtained with radioactive tracers or from thermal neutron activation analysis. Measurements were taken with several Group III and Group V impurities up to concentrations of 6×10^{19} (cm^{-3}) and 6×10^{18} (cm^{-3}) for n- and p-type silicon, respectively. The conductivity mobility can be calculated from these data by considering the percentage of ionized impurities. The electron mobility approaches 80 $cm^2/(V\ sec)$ and the hole mobility 60 $cm^2/(V\ sec)$ for the highest impurity concentrations. The comparison with measured Hall mobilities leads to a ratio μ_H/μ_C which agrees with theory. A comparison with the existing theory of impurity scattering yields better agreement for n-type silicon than for p-type. In the latter the measured mobilities are considerably smaller than the theoretical values. A.

537.311.33

6998. THERMAL GENERATION OF RECOMBINATION CENTERS IN SILICON. B.Ross and J.R.Madigan.
Phys. Rev., Vol. 108, No. 6, 1428-33 (Dec. 15, 1957).

Measurement of minority-carrier lifetime v. bulk resistivity in diffused silicon p-n junctions shows that Hall–Shockley–Read statistics are obeyed. Measurement of lifetime v. temperature yields information regarding the depth of the trapping level in the forbidden gap. Lifetime v. temperature data were taken on junctions which were annealed, quenched, and reannealed. A trap level of approximately 0.1 eV above the valence band in both conductivity types of silicon was deduced from the data. The curves indicate that the energy levels remained fixed, regardless of treatment, but the density of centres changed. Ambient temperature lifetimes were measured for p-n junctions which were quenched from a number of different temperatures. This resulted in a Boltzmann-type relationship yielding a formation energy (approximately 1 eV) for the creation of a defect. Mechanisms explaining the observed phenomena are discussed. A.

537.311.33

6999. THE EFFECT OF THERMAL TREATMENT ON THE ELECTRICAL PROPERTIES OF SILICON.
E.I.Givargizov and Ya.E.Pokrovskiĭ.
Zh. tekh. Fiz., Vol. 28, No. 5, 974-6 (1958). In Russian.

Changes in the resistivity ρ and lifetime τ of single crystal specimens of p-type Si ($\sim 3.10^{14}$ holes/cm^3, $\tau \sim 300\ \mu$sec before heat treatment) caused by heat treatments (200-600° C) were studied. The light spot method (with precautions to ensure reliability) was used to measure τ. No changes in ρ were observed (the Si crystals were apparently obtained without using silica crucibles). Decreases in τ (depending on the temperature of heat treatment) were found when resistance furnace heating was used, but not when high frequency heating was used and the rest of the apparatus was kept cold. It is concluded that the changes in τ were due to an impurity originating from the silica apparatus when it was heated. K.F.Hulme

537.311.33

7000. NONLINEAR SEMICONDUCTORS BASED UPON ZnO–TiO_2. Kh.S.Valeev and M.D.Mashkovich.
Zh. tekh. Fiz., Vol. 27, No. 8, 1649-51 (1957). In Russian. English translation in: Soviet Physics — Technical Physics (New York), Vol. 2, No. 8, 1533-5 (Aug., 1957).

Certain electrical properties of the polycrystalline oxide semiconductor ZnO–TiO_2 are investigated. The proportions of the oxides vary from almost pure ZnO to compositions containing 30-40% mole TiO_2. It is found that such semiconductors exhibit various types of conductivity. The non-linear coefficient α ($u = cI^{\alpha}$, where I is the current, u the voltage and c a constant) is determined for various mixtures, and it is postulated that the non-linearity is caused by electron-hole junctions. Applications in special engineering devices are suggested. R.Bullough

537.311.33 : 539.2

DISTRIBUTION COEFFICIENTS FOR SOLUTE ELEMENTS IN SINGLE CRYSTAL INDIUM ANTIMONIDE. See Abstr. 6413

537.311.33 : 539.21

EFFECT OF IRRADIATION ON THE HOLE LIFETIME OF N-TYPE GERMANIUM. See Abstr. 6421

537.311.33 : 621.382

7001. IMPEDANCE OF BULK SEMICONDUCTOR IN JUNCTION DIODE. T.Misawa.
J. Phys. Soc. Japan, Vol. 12, No. 8, 882-90 (Aug., 1957).

The impedance of bulk semiconductor in a junction diode (defined as the "imref drop" for majority carriers divided by the total current through the junction) is calculated using the low-level solution of minority carriers and is shown to have an inductive reactance, which becomes increasingly dominant over the capacitive reactance of the impedance of the junction proper. Therefore the impedance of the whole diode turns inductive as the injection level rises. A.

537.311.33 : 621.382

7002. ANALYSIS OF CURRENT FLOW IN A PLANAR JUNCTION DIODE AT A HIGH FORWARD BIAS. A.K.Jonscher.
J. Electronics and Control, Vol. 5, No. 1, 1-14 (July, 1958).

A new approach is made to the analysis of high-injection-level current flow in a p-n junction diode with planar geometry. The analysis is concerned with the general case of an asymmetric diode, the impurity concentrations and widths on both sides being arbitrary. It is shown that with certain simplifying assumptions the following voltage–current relation is obtained: $I^{1/2} = S(V-V_0)$, where the coefficient S is given quantitatively as a function of the physical and geometrical parameters of the diode and V_0 is the equilibrium diffusion potential of the junction. A.

537.311.33

7003. ON THE SEMICONDUCTING PROPERTIES OF HERZENBERGITE (SnS) CRYSTALS. H.Gobrecht and A.Bartschat.
Z. Phys., Vol. 149, No. 4, 511-22 (1957). In German.

Single crystals were grown from the vapour phase using Frerichs' method for CdS. The crystal structure was found by X-ray examination; with a = 3.99 A, b = 4.32 A, and c = 11.18 A. The absorption edge was determined for single crystals, evaporated layers, and powdered specimens. Optical anisotropy for light passing in the c-direction was measured. The room temperature energy gap was of the order of 1.25-1.28 eV. Rectification effects in single crystals and photoconductivity in evaporated layers were observed. Irreversible processes in evaporated layers resulted from treatment in oxygen. C.A.Hogarth

537.311.33

7004. DETERMINATION OF DIFFUSION LENGTH (L) AND CARRIER DENSITY IN THE INVERSION LAYER (n_i) FROM THE FORWARD CHARACTERISTIC OF ALLOYED-JUNCTION SILICON RECTIFIERS. A.Herlet.
Z. angew. Phys., Vol. 9, No. 4, 155-8 (April, 1957). In German.

The deviation of measured characteristics from the simple theory is interpreted as due to a variation of L with current, i.e. with the density of injected carriers. Elaboration of the theory to take account of this enables both L and n_i to be derived. K.W.Plessner

537.311.33

7005. THE EQUILIBRIUM DISTRIBUTION OF POTENTIAL, FIELD AND CARRIER CONCENTRATIONS IN ALLOYED JUNCTION. É.I.Adirovich, Yu.S.Ryabinkin and K.V.Temko.
Zh. tekh. Fiz., Vol. 28, No. 1, 55-66 (1958). In Russian.

Calculations were carried out for zero nett current across the p–n junctions; only step-function changes of impurity concentrations were considered; the contribution of the free carriers to the space charge was included (it is usually ignored in approximate treatments). Results were calculated in typical cases using an electronic computer, and are presented graphically. The divergences from approximate treatments are large when one side of the junction is nearly intrinsic. K.F.Hulme

537.311.33 : 621.382

7006. THE EFFECT OF IONIC BOMBARDMENT ON THE CURRENT–VOLTAGE CHARACTERISTICS OF SILICON POINT-CONTACT DIODES. S.M.Faĭnshteĭn and O.S.Lyĭsogorov.
Zh. tekh. Fiz., Vol. 28, No. 3, 493-7 (1958). In Russian.

Point-contact diodes prepared from n-type, 3-30 ohm cm Si single crystals bombarded with A, He or O ions were found to be characterized by comparatively high break-down voltage (70-300 V), and correspondingly low reverse-current values, the best results being obtained when O ions were used. The effects of the bombardment varied from specimen to specimen and across the surface of a given crystal. No change in their characteristics was observed in the specimens left in air for a week after the treatment. Since an amorphous or polycrystalline layer was formed on the surface of the single crystals as a result of the ionic bombardment, indicating the possibility of other lattice defects (lattice vacancies, interstitial atoms), it is postulated that the observed changes of the current–voltage characteristics are due to a decrease of the concentration of the effective current carriers on the surface of the crystals resulting from the introduction of new capture centres in the forbidden band.
M.H.Sloboda

537.311.33 : 621.314.632

7007. THE EFFECT OF THE UPPER ELECTRODE MATERIAL ON THE ELECTRICAL PROPERTIES OF COPPER OXIDE RECTIFIERS. F.A.Makovskiĭ and E.P.Usachev.
Zh. tekh. Fiz., Vol. 28, No. 4, 788-9 (1958). In Russian.

The efficiency of semiconductor rectifiers depends on the material of the upper electrode owing to the fact that the metal electrode/semiconductor interface is usually characterized by unipolar conductivity. It was shown experimentally that with the changing material of the upper electrodes made from chemically pure materials and deposited, when applicable, by evaporation in vacuo (10^{-5} mm Hg), the forward current through CuO specimens identical in all other respects decreased in the following order: Au, Ag, Pb–Bi–Cd alloy, Hg, colloidal C, Zn, Cd, Bi, Te, Sn, Ge, Cu, Al, Sb, Pb, Cr, Tl. The reverse current was not affected by variation of the electrode material.
M.H.Sloboda

537.311.62 : 537.312.8

7008. STUDY OF SURFACE IMPEDANCE OF TIN [AT 9300 Mc/s] IN WEAK MAGNETIC FIELDS.
P.A.Bezuglyĭ and A.A.Galkin.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 237-8 (1958). In Russian.

537.312.5

7009. PHOTOELECTRIC PROPERTIES OF ANTIMONY TRISULPHIDE LAYERS. C.Kunze.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 173-82 (1958). In German.

The spectral distribution of the photoconductive response of Sb_2S_3 layers was measured in a Vidicon-type tube. For thin layers (0.2 μ) a peak occurs at 0.55 μ, which shifts to longer wavelengths with thicker layers. A good fit was obtained with calculated curves on the assumptions that electrons were the mobile charge carriers and diffusion could be neglected.
J.Franks

537.312.5 : 621.383

7010. PHOTOCONDUCTIVITY. D.A.Wright.
Brit. J. appl. Phys., Vol. 9, No. 6, 205-14 (June, 1958).

The basic factors influencing photoconductivity are discussed, and the general pattern of behaviour to be expected is indicated. The preparation and properties of cadmium sulphide are dealt with in some detail. Other photoconducting compounds are described more briefly, and it is shown that their properties also fit into the general pattern. A discussion is given of the nature of the impurities and defects in the crystal lattice which influence the sensitivity, and the applications of photoconductors are outlined briefly.
A.

537.312.5 : 539.21

7011. PHOTOCONDUCTIVITY OF ANTHRACENE. THE EFFECT OF NEUTRON BOMBARDMENT.
D.M.J. Compton, W.G.Schneider and T.C.Waddington.
J. chem. Phys., Vol. 28, No. 4, 741-2 (April, 1958).

Anthracene crystals were irradiated with neutrons at doses of 5×10^{14} and 9×10^{16} neutrons/cm^2. Both crystals became coloured, the former yellow, the latter deep red. Large decreases in fluorescence were observed, and while the dark current was greatly increased by irradiation, the photocurrent was greatly decreased. The photocurrent voltage curves also showed qualitative changes, e.g. non-ohmic to ohmic.
A.B.Lidiard

537.312.5 : 612.843.32

7012. PHOTOCONDUCTIVITY AND THE VISUAL RECEPTOR PROCESS. B.Rosenberg.
J. Opt. Soc. Amer., Vol. 48, No. 8, 581-2 (Aug., 1958).

β-carotene crystals are photoconductive. On illumination with a 150 W tungsten lamp their dark-conductivity increases by a factor of 3000. The intensity variation and time course of the phenomenon provide suggestive analogies for visual effects and may even provide a mechanism for colour discrimination.
R.A.Weale

537.312.5 : 535.343

7013. PHOTOELECTRIC AND OPTICAL PROPERTIES OF HgI_2. D.V.Chepur.
Radiotekhnika i Elektronika, Vol. 2, No. 3, 278-86 (1957). In Russian.

Mono- and polycrystalline specimens were studied for the variation of: (a) photoconduction decay lifetimes with wavelength (570-640 mμ) for different crystals; (b) photoconduction quantum efficiency with temperature (25-125°C) and wavelength (588-632 mμ); (c) optical absorption with wavelength (520-640 mμ). The effect of background illumination on X-ray stimulated photoconductivity was also studied. The apparatus used for the measurements is described. See also Abstr. 8209 (1956).
C.H.L.Goodman

537.312.5

7014. INVESTIGATION OF REASONS FOR DECREASE OF THE PHOTOSENSITIVITY OF CdS SINGLE CRYSTALS IN THEIR ABSORPTION RANGE.
V.Ye.Lashkar'ov, Ye.A.Sal'kov, H.A.Fedorus and M.K.Sheĭnkman.
Ukrayin. fiz. Zh., Vol. 2, No. 3, 261-73 (1957). In Ukrainian.

Measurements were made of the variation with λ of photocurrent, photocurrent efficiency, mobility and lifetime of photocarriers, reflection and transmission coefficients of the CdS single crystal. The effects observed are considered to be explainable upon a hypothesis of non-photoactive exciton annihiliation at the crystal surface when absorbing strongly-absorbed light.
C.R.S.Manders

537.312.5

7015. LONGITUDINAL PHOTOCONDUCTIVITY OF Cu_2O SINGLE CRYSTALS. O.V.Snitko and Yu.I.Hrytsenko.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 70-2 (1957). In Ukrainian.

The preparation of the experimental specimen is described in some detail, together with the method of depositing gold electrodes on it. The specimen is illuminated by rectangular pulses of light (4600 A) that has passed through an interference filter. Analysis of the dark current and photocurrent curves appears to support the view that the photocurrent is composed of three components.
C.R.S.Manders

537.312.5

7016. ON THE PECULIARITIES OF PHOTOCONDUCTIVITY IN CADMIUM SELENIDE. S.V.Svechnikov.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 548-54 (1958). In Russian.

Peculiarities of the photoconductivity in single crystals of cadmium selenide excited by red light of λ = 7740 A and by X-rays are considered. The first case corresponds to linear conductivity and the second case to nonlinear photoconductivity. A two-stage excitation scheme is proposed for explanation of the observed photoconductivity irregularities observed in single crystals of CdSe.
A.

537.312.5

7017. THE INFLUENCE OF ADSORBED MOLECULES ON THE LONGITUDINAL PHOTOCONDUCTIVITY OF CUPROUS OXIDE. O.V.Snitko.
Zh. tekh. Fiz., Vol. 28, No. 1, 35-44 (1958). In Russian.

The specimens studied were plates, 200 μ thick, of Cu_2O annealed at 1000° C, on opposite faces of which translucent Au films were deposited (10^{-8}-10^{-5} cm thick) to form electrodes. One electrode was illuminated by pulsed light (often monochromatic) and could be exposed to various pressures of C_3H_5OH vapour. The results are given in 10 graphs and 4 tables. In the dark the volt–amp. curves for the specimens were ohmic ($\sim 3 \times 10^5$ ohm/cm^2) and the hole mobility was ~ 50 cm^2 V^{-1} sec^{-1}. Under illumination, the volt–amp. curves were similar to those of rectifiers and indicated minority carrier lifetimes $< 10^{-7}$ sec; there was a positive photovoltage, showing the presence of an "anti-blocking" layer on the p-type material. The decay of photoconductivity for an applied voltage V could be approximated as the sum of two exponentially decaying components with time constants of ~ 1 and ~ 10 milliseconds. By analysing how these components changed with V and the pressure of C_3H_5OH present, it was concluded that: the most rapidly decaying component was associated with volume recombination and the other with surface recombination;

adsorbed molecules of C_2H_5OH diminished the negative surface charge. The results using Au films $< 4 \times 10^{-6}$ cm thick were anomalous.

K.F.Hulme

537.312.5

7018. THE INERTIA OF THE PHOTOEFFECT AND ELECTRICAL CONDUCTIVITY OF CUPROUS OXIDE. A.L.Rvachev.
Zh. tekh. Fiz., Vol. 28, No. 1, 45-51 (1958). In Russian.

The specimens were single crystals or large-grained polycrystalline plates 10 mm square and 0.25 mm thick; they were obtained by oxidation of Cu at ~ 1000° C in air — heating and cooling being performed in vacuo. To obtain lower conductivities some specimens were annealed in vacuo at 1000° C for 5-30 min. Specimen conductivities, σ, ranged from 3×10^{-8} to 5×10^{-3} mho cm^{-1}. The specimens were illuminated by chopped monochromatic light of adjustable wavelength, λ, (400-950 mμ); the apparatus used to study the decay of the photoeffect is described. For long λ the decay was exponential but at short λ it was the sum of two exponentially decaying components. On the basis of the nature of the decay, the spectrum could be divided into six regions — the behaviour changing at five well-defined values of λ; two of these wavelengths corresponded to those associated with the formation and dissociation of excitons. Graphs of photosensitivity against λ showed breaks at the same wavelengths; the photosensitivity curves were a function of the temperature of oxidation. The complicated energy levels of Cu_2O, the formation of electron–hole pairs by the incident light, the infrared luminescence of Cu_2O and the role of excitons are considered in the discussion of the results.

K.F.Hulme

537.312.5

7019. AN INVESTIGATION OF THE PHOTOELECTRIC PROPERTIES OF THE LEAD SULPHIDE GROUP OF SEMICONDUCTORS BY THE CONDENSER METHOD.
B.T.Kolomiets and V.N.Larichev.
Zh. tekh. Fiz., Vol. 28, No. 5, 921-4 (1958). In Russian.

Powders (ground polycrystalline material) and evaporated films of PbS, PbSe, and PbTe were studied; sensitizing treatments (e.g. by heating in air or oxygen) were not given, and the photo-effects were thus too small to measure conveniently by the usual methods. The spectral sensitivities peaked at 0.4-0.5 μ and were effectively zero beyond 0.9 μ; the signs of the photo-voltages showed many anomalous features; the time constants were 10^{-2}-10^{-3} sec. It is concluded that the explanations applicable to sensitized films (which involve excitations across the forbidden gap in the interior of the semiconductor) are not valid here, and it is suggested that deep surface levels associated with absorbed O_2 are important (the material was apparently exposed to the atmosphere during measurements).

K.F.Hulme

537.312.5

7020. PHOTOVOLTAIC PILE. I.Levin.
Nature (London), Vol. 181, 44-5 (July 12, 1958).

A description is given of a photovoltaic pile in which the elements are connected in series. The instrument is said to represent an analogue of electric fish.

R.A.Weale

537.312.5

7021. ABSORPTION OF LIGHT IN Se NEAR THE BAND EDGE.
W.J.Choyke and L.Patrick.
Phys. Rev., Vol. 108, No. 1, 25-8 (Oct. 1, 1957).

A photovoltaic method was used to measure the relative absorption in hexagonal Se of photons of energy from 1.6 to 2.0 eV in the temperature range from 80° to 440° K. The measurements show that the transitions are indirect at the band edge, requiring the absorption or emission of a phonon. The energy gap is found to be (1.79 ± 0.01) eV at 330° K; above this temperature $dE_G/dT = -9 \times \times 10^{-4}$ eV/degree. The absorption edge of hexagonal Se is compared with that of amorphous Se.

A.

537.312.5

7022. THE GENERATION OF A PHOTO-E.M.F. IN LEAD SULPHIDE LAYERS. R.Ya.Berlaga, M.A.Rumsh and L.P.Strakhov.
Radiotekhnika i Elektronika, Vol. 2, No. 3, 287-90 (1957).
In Russian.

It is suggested that evaporated PbS layers consist of a mass of acicular dendrites oriented towards the evaporation source. Confirmatory evidence for this is obtained from: (a) the reflection of light from such layers; (b) the marked dependence of the photo-e.m.f. on the direction of incident light (a polar diagram is shown indicating zero response along a line passing through the evaporation source with change of sign on crossing it); (c) electron microscopy of deposits on thin filaments. Various mechanisms for the generation of the photo-e.m.f. are discussed.

C.H.L.Goodman

537.312.5

7023. PHOTOELECTRIC EFFECT FROM BOROSILICATE GLASS. V.K.Rohatgi.
J. appl. Phys., Vol. 28, No. 9, 951-9 (Sept., 1957).

Values of the photoelectric quantum efficiency of glass for different wavelengths were determined and data obtained on the statu of electrons placed on glass surfaces. One of the borosilicate glasses commonly used in discharge tube manufacture and soda glas were studied in vacuum with 2537 A photons from a quartz Heraeus mercury arc and with light from a glow discharge operating in pure A and Ne from 10^{-1} to 10 mm pressure. Clean borosilicate glass in vacuum at 22°C with fields of about 100 V/cm across it yields photo-electric current densities of the order of 10^{-12} A/cm² for the full light of a 110 V arc focused on 10 cm² area through quartz optics. This current comes from the 3-4% Na impurity atoms on the surface Soda glass yields currents in proportion to the density of Na atoms. The normal conductivity of the glass comes from Na^+ ions of some 0.5 V activation energy normally present. It is enhanced tenfold by Na^+ ions liberated at the surface by light. Na^+ ions next the cathode cannot leave the glass, but electrons enter the glass from the metal cathode backing of lower work function to neutralize the ion space charge as it builds up near the cathode. Electrons sprayed onto the glass surface have a mobility of $\sim 5 \times 10^{-5}$ cm²/(volt sec) in the glas in contrast to the value of $\sim 1 \times 10^{-7}$ cm²/(volt sec) for the Na^+ ions reported by Kraus. Photons above 3300 A do not contribute to the conductivity in any fashion. The photoelectric yield for 2537 A was obtained directly in absolute magnitude by use of a vacuum bolomete For the light from glow discharges $\ll$ 1200 A, the efficiency was obtained indirectly by comparison with values for Pt and Au.

A.

537.312.5 : 537.533.8 : 621.383

7024. ON THE DISTRIBUTION OF ELECTRON ENERGIES FROM ANTIMONY–CAESIUM CATHODES. A.I.Pyatnitskii.
Radiotekhnika i Elektronika, Vol. 2, No. 6, 714-25 (1957). In Russian

Describes experiments on Sb–Cs cathodes and Ag–Cs layers under both photoelectric and secondary emission. Current/voltage curves are given for 5461 and 4358 A, and for secondary emission at 75 and 150 V. Curves of electron energy distributions are deduce from these curves. There is a displacement of 0.2-0.4 V between the stopping potential for the Ag–Cs layer and for the Sb–Cs cathode. The energy scheme for the Sb–Cs cathode is discussed.

J.M.Hough

537.312.5

7025. THE EFFECT OF MOLECULAR ABSORPTION ON THE FIELD EFFECT IN Cu_2O [SINGLE CRYSTALS]. O.V.Snitko.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 68-9 (1957). In Ukrainian.

Dark current v. electric field measurements were made both in alcohol vapour at 28 mm Hg pressure and in vacuum. Molecular adsorption is shown to markedly decrease the dark current, presumably by a screening effect with respect to the electric field.

C.R.S.Manders

537.312.5

7026. YIELD OF ELECTRONS EMITTED UNDER THE ACTION OF γ-RAYS. M.V.Chatskevich and É.M.Tsenter.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 807-10 (1958). In Russian.

The absolute yield of electrons from an aluminium target of effective thickness (i.e. of the order of the path length of a secondar electron with maximum energy) produced by 2.62 MeV γ-quanta is determined experimentally and computed theoretically.

A.

537.312.5 : 537.533.2

OUTER PHOTOELECTRIC EFFECT FOR GERMANIUM AFTER ELECTRON BOMBARDMENT. See Abstr. 5953

537.312.6

7027. SUPERCONDUCTIVITY OF BERYLLIUM FILMS CONDENSED ON A COLD BACKING.
B.G.Lazarev, A.I.Sudovtsov and A.P.Smirnov.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1059-60 (1957). In Russia English translation in: Soviet Physics — JETP (New York), Vol. 6. No. 4, 816-17 (April, 1958).

Films about 10^{-6} cm thick, condensed at 4° K, are found to be superconducting below about 8° K.

R.G.Chambers

537.312.62

7028. A REMARK ON THE COUPLING OF ELECTRONS IN A METAL IN PAIRS WITH ANTIPARALLEL SPIN, AND THE THEORY OF SUPERCONDUCTIVITY. J.des Cloizeaux.
C.R. Acad. Sci. (Paris), Vol. 246, No. 6, 904-6 (Feb. 10, 1958).
In French.

The creation and annihilation operators for pairs of electrons used in the B.C.S. theory of superconductivity are not invariant

with respect to the rotation group, as they should be. However, it is shown that if suitably modified invariant operators are used instead, the results are unchanged. R.G.Chambers

537.312.62

7029. A CORRELATION FOR THE ENERGY GAP IN SUPERCONDUCTORS. B.B.Goodman.
C.R. Acad. Sci. (Paris), Vol. 246, No. 21, 3031-4 (May 28, 1958). In French.

The ratio ϵ_0/kT_c is calculated for 17 superconductors from the ratio $\gamma H_0^2/T_c^2$, using the B.C.S. relation between the two. It varies from 1.4 to 2.0 for different superconductors, and shows a marked correlation with T_c/θ_0. ($2\epsilon_0$, H_0, θ_0 mean energy gap, critical field, and Debye temperature at 0°K, respectively. T_c is the transition temperature, γ is the electronic specific heat term). R.G.Chambers

537.312.62

7030. ON THE THEORY OF SUPERCONDUCTIVITY OF METALS. S.V.Vonsovskiĭ and M.S.Svirskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 2, 269-72 (1958). In Russian.

A charged boson gas is superconducting. Charged elementary bosons do not exist naturally in metals but a small, even, number of electrons tightly bound in comparison with lattice forces could constitute an "effective boson". Possible theoretical explanations for such forces between electrons are explored. J.W.Gardner

537.312.62 : 538.222

7031. PARAMAGNETIC SUSCEPTIBILITY IN SUPERCONDUCTORS. K.Yosida.
Phys. Rev., Vol. 110, No. 3, 769-70 (May 1, 1958).

A calculation of the expected Knight shift in a superconductor, on the basis of the B.C.S. theory. It is found that the shift should fall to zero at low temperatures, in agreement with an experimental result of Knight et al., but in marked disagreement with the results of Reif (Abstr. 5353/1957). R.G.Chambers

537.312.62

7032. CONCERNING THE REALITY OF THE NON-STATIONARY MODEL OF THE INTERMEDIATE STATE. A.I.Shal'nikov.
Zh. éksper. teor. Fiz., Vol. 33, No. 4 (10), 1071-2 (1957).
In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 6, No. 4, 827-8 (April, 1958).

The intermediate state of a current-carrying tin rod in a small transverse field was investigated at 3.5°K, using Bi probes and magnetic powder patterns. The domain structure on the surface was found to be stationary, and not continuously changing with time as suggested by Gorter (Abstr. 8640/1957). R.G.Chambers

537.312.62

7033. MEASUREMENT OF THE SURFACE IMPEDANCE OF SUPERCONDUCTORS AT 9400 Mc/s. L.A.Prozorova.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 14-22 (1958). In Russian.

The surface impedance of superconductors was measured at 9400 Mc/s. The temperature dependence of the surface impedance of thin Sn and Hg films was investigated. The penetration depth for these films was determined and found to be in accord with critical magnetic field measurements. The effective conductivity of films in the superconducting state increases with decrease of the temperature. Dependence of the impedance of thin Sn and Hg films on the magnetic field strength was investigated at $T < T_c$. Dependence of the penetration depth on field strength agrees satisfactorily with the Landau—Ginsburg theory. A.

537.312.62

7034. CONCERNING A NEW METHOD IN THE THEORY OF SUPERCONDUCTIVITY. I. N.N.Bogolyubov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 58-65 (1958). In Russian.

The canonical transformation method previously developed for superfluidity theory is generalized. By application of this method and of the principle of compensation of "dangerous" diagrams, it is shown that a superconducting state is inherent in the model. Computation of the main parameters of this state leads to formulae which confirm the Bardeen—Cooper—Schrieffer theory. A.

537.312.62

7035. CONCERNING A NEW METHOD IN THE THEORY OF SUPERCONDUCTIVITY. II. V.V.Tolmachev and S.V.Tyblikov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 66-72 (1958). In Russian.

In the adiabatic approximation, equivalence of the Bardeen Hamiltonian and the Fröhlich Hamiltonian is established and the energies of the ground state and elementary excitations are calculated by the method of canonical transformations. (See preceding abstract). A.

537.312.62

7036. CONCERNING A NEW METHOD IN THE THEORY OF SUPERCONDUCTIVITY. III. N.N.Bogolyubov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 73-9 (1958). In Russian.

The Bardeen Hamiltonian is analysed and a method given for the summation of the principal diagrams. It is shown that this procedure yields the same results as those obtained in Pt I and II. (See preceding abstracts). A.

537.312.62

7037. APPLICATION OF A VARIATIONAL PRINCIPLE TO A NEW METHOD IN THE THEORY OF SUPERCONDUCTIVITY. I.A.Kvasnikov.
Dokl. Akad. Nauk. SSSR, Vol. 119, No. 3, 475-7 (1958). In Russian.

Previously (Abstr. 4524/1957) the author put forward a method for deriving the statistical mechanics of ferromagnets in Weiss' approximation from a variational principle. In the present paper the previous results are applied to the transition point of superconductors. The Hamiltonian of electrons in a superconductor is formulated in accordance with the theory of Bardeen, Cooper and Schrieffer (Abstr. 6193/1957). By means of a linear transformation of the quantized amplitudes the Hamiltonian is brought to the form of the Hamiltonian of a ferromagnet. It is found that the specific heat of superconductors becomes infinite at the transition point. R.Eisenschitz

537.312.62

7038. USE OF THE VARIATIONAL PRINCIPLE IN THE THEORY OF SUPERCONDUCTIVITY. I.A.Kvasnikov.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 4, 675-7 (1958). In Russian.

The thermodynamic properties of superconducting systems whose Hamiltonians are of more general form than those studied in a previous note (see preceding four abstracts) are investigated by Bogolyubov's method employing the variational principle. An explicit expression is derived for the thermodynamic potential of a given system. M.J.Kearsley

537.312.62

7039. ON THE DESTRUCTION AND CREATION OF SUPERCONDUCTIVITY IN A MAGNETIC FIELD. V.L.Ginzburg.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 113-25 (1958). In Russian.

Transition from the superconducting state to the normal, and vice versa, in the presence of an external magnetic field is considered. Critical magnetic field strengths H_c, H_{c1} and H_{c2} which correspond to equilibrium transition and to the boundaries of the supercooled and superheated regions respectively, are computed. Cases of small samples and of massive metals are considered. A.

537.312.62

7040. DISTRIBUTION OF MAGNETIC INDUCTION IN THE INTERMEDIATE STATE OF A SUPERCONDUCTOR WITH A CURRENT. B.V.Makeĭ.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 312-15 (1958). In Russian.

The distribution of the magnetic field in a slit cut out in the middle part of a tin cylinder with a current was measured by the bismuth probe method. The slit was located in the diametral plane of the cylinder. The results are compared with London and Landau's phenomenological theory of the distribution of current density in the intermediate state of a cylindrical superconductor. The existence of an intermediate state core in a superconducting wire carrying a current exceeding the critical current is directly proved by the experiments. A.

537.312.62 : 538.221

7041. ON THE THEORY OF FERROMAGNETIC SUPERCONDUCTORS. G.F.Zharkov.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 412-16 (1958). In Russian.

The conditions of existence of a superconducting state were obtained for massive uniform ferromagnetic samples possessing the form of ellipsoids of revolution. The direction of spontaneous magnetization forms an arbitrary angle θ_0 with the direction of the external field parallel to the axis of the revolution. Estimates are presented which show that the superconducting state can exist only for angles $\theta_0 < \sim 10^{-2}$. If this condition is satisfied, use of oblate samples with a large demagnetizing factor should formally favour the detection of superconductivity. A.

537.312.62 : 538.311

7042. THE SUPERCONDUCTING ELLIPTICAL CYLINDER IN A TRANSVERSE MAGNETIC FIELD. G.U.Schubert and H.Schmauch.
Z. Phys., Vol. 151, No. 4, 396-407 (1958). In German.

Calculation of the field and current distribution in a super-

conducting elliptical cylinder placed in an originally homogeneous magnetic field, according to the London theory. H.London

537.312.62 : 530.162

ON THE THEORY OF THE PHASE TRANSITION IN A NON-IDEAL BOSE-GAS. See Abstr. 6666

537.312.62 : 534.23

ULTRASONIC ATTENUATION IN SUPERCONDUCTING ALUMINIUM. See Abstr. 6754

537.312.8 : 538.66

7043. ON THE THEORY OF GALVANOMAGNETIC AND THERMOMAGNETIC EFFECTS IN METALLIC FILMS. É.A.Kaner.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 658-69 (1958). In Russian.

The electron distribution function and electric conductivity, thermal conductivity and Thomson coefficients were determined for a metallic film located in a constant magnetic field directed at an arbitrary angle with respect to the surface of the film. No special assumptions are made regarding the electron dispersion law. The region of strong magnetic fields is studied in detail. The agreement between theory and experiments is satisfactory. A.

537.323 : 532.72

7044. A METHOD OF MEASURING THE THERMOELECTRIC EFFECTS ACCOMPANYING THERMAL DIFFUSION IN AQUEOUS SOLUTIONS OF CHLORIDES. J.Chanu.
C.R. Acad. Sci. (Paris), Vol. 246, No. 1, 67-70 (Jan. 6, 1958). In French.

A brief description of the experimental method is given. The results are compared with theory and good agreement is obtained. H.C.Cole

537.323

7045. CHANGES IN THERMOELECTRIC POWER OF SILVER AND GOLD WITH COLD WORK AT LIQUID NITROGEN TEMPERATURE. E.W.Kammer.
J. appl. Phys., Vol. 29, No. 7, 1122 (July, 1958).

In contrast to previous experiments the wires were plastically deformed at 7°K and measurements were made at this temperature. By this means the annealing of defects introduced when the deformation is carried out at 290°K is reduced. Two annealing processes which affect thermoelectric power in opposite senses are identified. C.A.Hogarth

537.323

7046. STRUCTURE IN THE THERMOELECTRIC POWER OF DILUTE INDIUM–LEAD ALLOYS. W.J.Tomasch.
Phys. Rev., Vol. 109, No. 1, 69 (Jan. 1, 1958).

Liquid nitrogen and ice temperature measurements of the thermoelectric power of dilute indium–lead alloys indicate that there is detailed structure superimposed on the smooth trend of the data. Similar measurements are being made on the indium–thallium system to determine whether the structure is due to electronic or lattice effects. Those completed in the range of 4 to 9 atomic percent thallium indicate that the thermoelectric power varies linearly with composition in this interval. Hence it is presumed that the structure of the indium–lead data in this interval is of electronic origin. A.

537.323

7047. SOME LIMITATIONS OF THE THERMOELECTRIC EFFECTS IN SEMICONDUCTORS. O.Böttger.
Z. Phys., Vol. 151, No. 3, 296-306 (1958). In German.

The efficiency of a loaded thermo-element and the maximum temperature drop of a Peltier element are calculated. A dimensionless quantity is defined, in terms of which the goodness of a thermocouple can be expressed, and the concept is extended to the characterization of a single material. An upper limit is established for this "absolute thermo-metal number", and in this way the maximum efficiency of a thermo-generator and the maximum temperature drop of a cooling element can be computed. It is concluded that utilizable semiconductors must fall within a conductivity range of from 10^2 to 3×10^3 ohm^{-1} cm^{-1}. T.P.Brody

537.323

7048. A STUDY OF THE THERMOELECTRIC PROPERTIES OF SOLID SOLUTIONS OF BISMUTH TELLURIDE AND BISMUTH SELENIDE.
G.N.Gordyakova, G.V.Kokosh and S.S.Sinani.
Zh. tekh. Fiz., Vol. 28, No. 1, 3-17 (1958). In Russian.

The aim of the work was to find an improved material for the negative element of thermoelectric cooling junctions. Solid solutions of Bi_2Te_3 and Bi_2Se_3 were studied both pure and doped; most of the work was done on the doped 80 : 20 alloy (mol %). The doping agents were either elements or metal halides; some doubly-doped specimens were studied. Measurements were made of: the thermoelectric power α; the electrical conductivity σ; the Hall constant; and the thermal conductivity κ. The elements of Groups 2, 3, 4, 5 and 8 were found to be acceptros, and Ag, Cu, Te, Se, and the halogens donors. The best thermoelectric properties were obtained for 80 mol % Bi_2Te_3, 20 mol % Bi_2Se_3 doped with either ~ 0.04 wt % CuBr or 0.06 wt % Cu; the values of the figure of merit, $\alpha^2\sigma/\kappa$, for these doped alloys were 2.5×10^{-3} and 2.2×10^{-3} (deg C)$^{-1}$, respectively. The results quoted above refer to room temperature but measurements of α and σ up to 300°C were made for the Cu- and CuBr-doped specimens. K.F.Hulme

537.323

7049. THE CHANGE OF THE COEFFICIENT OF THERMOELECTRIC FORCE OF TELLURIUM WITH ADDITIONS OF COPPER AND ANTIMONY DURING THE TRANSITION FROM THE SOLID TO THE LIQUID STATE (SHORT COMMUNICATION).
B.I.Boltaks and Tszyan Pi-Khuan.
Zh. tekh. Fiz., Vol. 28, No. 1, 222-4 (1958). In Russian.

The thermoelectric powers, α, were measured from 20-600°C; material, into which up to 1% by weight of Cu or Sb had been introduced, was studied. Additions of Cu or Sb did not affect α in the liquid; in the solid, Cu increased α slightly near the melting point, but Sb had a very small effect. Graphs are also given of the electrical conductivities of pure and Sb-doped specimens as a function of temperature. K.F.Hulme

537.324

7050. THE BEHAVIOUR OF THERMOCOUPLES IN INTERMITTENT IRRADIATION UNDER THE INFLUENCE OF INTERNALLY GENERATED HEAT WAVES. R.Kessler.
Z. angew. Phys., Vol. 9, No. 8, 408-12 (Aug., 1957). In German.

Six thermocouples of different construction and under different ambients were irradiated at frequencies up to 40 kc/s. The decrease in a.c. response with increasing frequency under identical conditions could not be described by a single relaxation time. The deviations depend on the heat waves generated in the metallic part of the thermocouple assemblies. C.A.Hogarth

ELECTRIC DISCHARGES

537.521.6

7051. THE INVESTIGATION OF IMPULSE BREAKDOWN OF GASES AND OF THE VELOCITY OF THE DEVELOPMENT OF ELECTRON AVALANCHE. A.Z.Éfendiev.
Zh. tekh. Fiz., Vol. 27, No. 5, 1010-18 (1957). In Russian.

Using the streamer theory of electrical breakdown it is shown that under certain experimental conditions the velocity of the electron avalanche is given by the quotient of the spark distance and the formative time lag. On this basis velocities have been determined for air, SF_6, and He for various values of X/p where X is the field strength and p is the pressure. It is found that the velocity of the electron avalanche can be taken in the first approximation as being proportional to X/p and that it depends on the nature of the gas. The description of the test apparatus used is given in some detail. E.M.Dembinski

537.521.6

7052. EFFECT OF THE ELECTRODE TEMPERATURE ON THE ELECTRIC STRENGTH OF A VACUUM GAP. I.N.Slivkov.
Zh. tekh. Fiz., Vol. 28, No. 4, 759-60 (1958). In Russian.

Impulse breakdowns were investigated between hemispherical electrodes, one of which could be heated to temperatures of up to 800°C. Results obtained using different metals (Ni, Fe, Cu and Al) suggest that gases and vapours of organic compounds adsorbed on the electrodes have no effect on the breakdown. Z.Krasucki

537.523

7053. EVAPORATION OF ACTIVE SPECIES TRAPPED IN A SOLID CONDENSED FROM "DISCHARGED" NITROGEN.
H.P.Broida and M.Peyron.
J. chem. Phys., Vol. 28, No. 4, 725-6 (April, 1958).

It was shown that the active condensate from a microwave discharge through nitrogen, which when condensed upon a cold (20°K) surface exhibits luminosity, may be evaporated from the surface, transported some tens of centimetres, and recondensed upon another cooled surface (1.2°K) where the luminosity processes are resumed. R.W.Nicholls

537.523.5

7054. MECHANISM OF ELECTRON EMISSION FROM THE ARC CATHODE. A.von Engel and A.E.Robson.
J. appl. Phys., Vol. 29, No. 4, 734 (April, 1958).

A general discussion of the high temperature and high local field theory of cathode spots, with special reference to the work of Lee (Abstr. 629/1958), Bauer (Abstr. 10209/1954), Dolan and Dyke (Abstr. 9290/1954). Reasons are given for doubting the validity of Lee's basic assumptions. J.D.Craggs

537.523.5

7055. ON THE DISCUSSION OF THE T–F THEORY BY ROBSON AND VON ENGEL. T.H.Lee.
J. appl. Phys., Vol. 29, No. 4, 734-5 (April, 1958).

A reply to the criticisms of von Engel and Robson (see preceding abstract). In particular reasons are given for a copper cathode spot temperature of 3500°K, repudiated by von Engel and Robson as being too high. The present author does not claim that his model applies to any but relatively high current arcs on low boiling point cathodes. J.D.Craggs

537.523.5

7056. PHYSICAL PHENOMENA DURING THE WORKING OF THE CATHODE OF AN ARC DISCHARGE IN CAESIUM VAPOUR.
N.D.Morhulis and P.M.Marchuk.
Ukrayin. fiz. Zh., Vol. 1, No. 1, 59-72 (1956). In Ukrainian, with summary (1 p.) in Russian.

The physical processes at the cathode are studied under conditions of high gas pressure, high current density and low current density. These data are used to elucidate the role of the various factors exerting notable effect on the dynamic equilibrium of the Cs layer on the cathode determining its emissivity. The distribution of energy in various regions of the discharge is also discussed.

C.R.S.Manders

537.525

7057. A METHOD OF STUDYING THE ELECTRIC DISCHARGE IN OZONIZERS. A.Pozwolski.
C.R. Acad. Sci. (Paris), Vol. 245, No. 22, 1900-3 (Nov. 25, 1957). In French.

A way of separating the discharge current proper, which is proportional to the ionic density, from the alternating current traversing the ionizer and from the discharge is indicated. The current exhibits a maximum at 0.85 mm Hg and consists of pulses the number of which increases with the applied voltage, but the height of the peaks remains constant. A.E.D.Heylen

537.525

7058. THE THEORY OF THE STRIATED POSITIVE COLUMN IN THE CASE OF RECOMBINATION WITHIN THE MAIN BULK.
I.M.Chapnik.
Zh. tekh. Fiz., Vol. 27, No. 5, 978-80 (1957). In Russian.

Previous work (Abstr. 5901/1956) considered the case with recombination taking place on the walls of the vessel and ignored recombination within the bulk of the gas; this paper does the reverse. It is concluded that the distance between striations decreases with increase of gas pressure and that this happens more rapidly than for cases where there is surface recombination. In the present case the distance between striations does not vary with radius but decreases proportionally as $\sqrt{r_c}$.

C.R.S.Manders

537.525.2

7059. CONTRIBUTION TO THE EXPLANATION OF HIGH VACUUM BREAKDOWN FROM FIELD-EMISSION PICTURES.
H.Tuczek.
Z. angew. Phys., Vol. 9, No. 8, 388-94 (Aug., 1957). In German.

Experimental results are given for the macroscopic breakdown field strength at the cathode (~ 0.2 to 1.8 MV/cm) as a function of gap distance (~ 0.5 to 50 mm) for several different sphere gaps (with copper and steel electrodes of radii from 0.125 to 4 cm) in a vacuum (< 10^{-6} mm Hg). Field emission pictures of copper and molybdenum points are also given for impulse voltages of up to 400 kV and of duration less than 10^{-6} sec. If the voltage or the duration of the pulse is increased breakdown occurs; the mechanism of the breakdown is discussed, and it is concluded that it results from the explosive evaporation of micropoints at the cathode. The d.c. results are discussed in terms of this mechanism. J.Dutton

537.525.4

7060. ON THE [LIGHT] EMISSION FROM GLIDING SPARKS IN VACUO AS A FUNCTION OF THE ELECTRICAL PARAMETERS OF THE DISCHARGE CIRCUIT. G.Balloffet and J.Romand.
C.R. Acad. Sci. (Paris), Vol. 246, No. 5, 733-6 (Feb. 3, 1958). In French.

High voltage (20-40 kV) sparks were studied with discharge capacitors of 0.25 to 2 μF. Spectroscopic studies of the intensities of various emission lines were made. The latter included lines of S VI, O VI, S IV, etc. J.D.Craggs

537.525.4

7061. INSTANTANEOUS BRIGHTNESS OF THE CHANNEL OF A SPARK DISCHARGE IN A CAPILLARY.
M.P.Vanyukov, A.A.Mak and M.Ya.Ures.
Optika i Spektrosk., Vol. 4, No. 1, 90-2 (1958). In Russian.

Curves and a table are given to show dependence of the brightness on the wavelength, circuit and discharge time and diameter of the capillary. L.Bovey

537.525.4

7062. ON THE MEASUREMENT OF THE TIME-DEPENDENT INCREASE IN CURRENT AT STATIC BREAKDOWN. R.Kluckow.
Z. Phys., Vol. 148, No. 5, 564-81 (1957). In German.

A slowly rising voltage (1.5 V/sec) was superimposed on a constant d.c. voltage applied to a uniform-field spark-gap so as to reach the sparking potential U. The ensuing currents crossing the gap were monitored as a function of time on a cathode-ray oscillascope connected across a resistance in series with the gap through a wide-band amplifier. Observations showed that single avalanches gave way to avalanche trains which often died away, but ultimately built up to a spark-producing current as the voltage increased. Two conditions, depending on the intensity of external u.v. illumination of a brass cathode 1 cm in diameter, were experimentally investigated: (1) during the development of the avalanche trains further initiating electrons were produced at the rate of 7.5×10^7 per sec; (2) the spark build-up of current was initiated by a single electron and no further electrons (rate 2×10^3 per sec) were liberated at the cathode during the development leading to breakdown. The initial linear build-up of current in air, at pressure differences of 136 (with U = 6950 V and $\alpha d = 8.6$) and 105 mm Hg (with U = 5775 V and $\alpha d = 9.5$), is explained by secondary photon action γ_L in accordance with theory of the Townsend-type (Abstr. 8430/1953, Abstr. 3825/1955), but final premature deviation from linearity, occurring approximetely 20 μsec after onset when the current reached 5 to 15 μA, is attributed in both cases to space charge distortion in the gap. Calculation shows that 50% departure from linearity due to the voltage rise should only occur after 3-15 msec and 35 μsec, respectively. Current build up in methane at a pressure difference of 61.5 mm Hg, with U = 3660 V, is attributed to streamer formation rather than to Townsend mechanism, because, once an electron avalanche reached a critical size on a statistical basis, a streamer resulted leading to breakdown within 0.3 μsec. A.E.D.Heylen

537.525.8

7063. EXCITATION IN A LOW PRESSURE ELECTRODELESS DISCHARGE. J.A.Harrison and J.D.Craggs.
J. Electronics and Control, Vol. 4, No. 4, 289-300 (April, 1958).

Describes measurements of relative intensities of spectral lines in the Balmer series, up to the 9th line. Self-absorption was allowed for, and the data are compared with Chamberlain's theoretical work. Pressures varied from 2 to 400 μ Hg; the low-pressure results are consistent with an electron temperature of about 10 000°K. J.D.Craggs

537.525.8

7064. THE LONGITUDINAL PRESSURE GRADIENT IN DISCHARGE TUBES. R.B.Cairns and K.G.Emeléus.
Proc. Phys. Soc., Vol. 71, Pt 4, 694-8 (April, 1958).

Describes a method for measuring longitudinal pressure differences (between anode and cathode) using a differential oil manometer in low-pressure glow discharges. Detailed data are given for argon and helium at pressures of about 0.05 to 5 mm Hg and 0-240 mA current. There is a brief discussion.

J.D.Craggs

537.525.9

7065. SPACE POTENTIAL AND ELECTRODE SPUTTERING IN A HIGH-FREQUENCY DISCHARGE. S.M.Levitskiĭ.
Zh. tekh. Fiz., Vol. 27, No. 5, 1001-9 (1957). In Russian.

Using a probe electrode and by measuring the energy of ions produced in a h.f. discharge, it was found that at frequencies of the order of 10^6-10^8 c/s and at pressures of 10^{-2}-1 mm Hg, there exists a high positive space potential, comparable in magnitude with the amplitude of the h.f. voltage applied to the electrodes. This is due to an excess of positive ions in the discharge region caused by the electrons in the discharge being preferentially attracted toward the electrodes because of their greater mobility. From this it follows

that the reason for the observed great emission of the electrodes is this positive space potential which causes ions to be forced out from the discharge toward the electrodes with high energies. Some characteristics of the probe electrode used in measurements are discussed. E.M.Dembinski

537.525.92

7066. SIGN OF THE SPACE CHARGE ON THE AXIS OF A POSITIVE COLUMN IN A LONGITUDINAL MAGNETIC FIELD. M.V.Konyukov.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1039-40 (1957).
In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 6, No. 4, 798-9 (April, 1958).

Compares experimental data and theoretical predictions on the value of magnetic field that causes reversal in sign of the radial gradient. C.G.Morgan

537.528 : 534.222.2

IMPULSE SOUND SOURCES, FUNDAMENTALS AND ANALOGY TO EXPLOSIVE TRANSFORMATIONS. See Abstr. 6750

537.528 : 534.222.2

THE SOUND IMPULSE OF A LIQUID SPARK. See Abstr. 6752

537.529 : 536.422

ELECTRIC-WIRE EXPLOSIONS. See Abstr. 6910-11

X-RAYS

537.531 : 535.331

7067. THE K X-RAY ABSORPTION EDGE OF ALUMINUM IN METAL AND OXIDE. L.Rudström.
Ark. Fys., Vol. 12, Paper 10, 287-94 (1957).

The Al K-absorption edges of technical and pure aluminium metal and aluminium oxide (Al_2O_3) were recorded and measured. The fine structure very close to the K-absorption edge of metallic aluminium earlier reported by Cauchois (1952) has not been found. The width of the K-level of aluminium and the energy gap of aluminium oxide are determined. There is a great similarity between the K-absorption edge and the high-frequency edge of the emission line ($K\beta$) of the aluminium metal as well as between the edges of the aluminium oxide. The wavelength values of the former edges agree within the limits of error. A.

537.531 : 535.331

7068. THE RATIO OF CHARACTERISTIC TO WHITE X-RADIATION FROM A COPPER TARGET. E.G.Bendit.
Brit. J. appl. Phys., Vol. 9, No. 8, 312-17 (Aug., 1958).

The ratio (k) of the total $K\alpha$ radiation to the total white radiation emitted by copper target X-ray tubes has been estimated by isolating the contribution of wavelengths near $\lambda K\alpha$ with balanced nickel and iron filters. The total radiations leaving the tube have been inferred from the counting rates of a Geiger counter exposed to the direct beam from the X-ray tube (suitably attenuated by a pinhole system). Corrections for transmission of the air path and quantum efficiency of the Geiger counter as functions of wavelength were applied to an assumed spectral distribution for the white radiation. The assumed spectral distribution was selected on the basis of a literature survey of investigations on continuous spectra, a brief outline of which is given. It is found that at 35 kV , $k = 2.2$, a result which lies between those of Arndt and Riley (Abstr. 4413/1952), who found $k = 5.4$, and of Parrish and Kohler (Abstr. 1750/1956), from whose curves a value of $k = 0.35$ is deduced. A measure of reconciliation between these results is achieved if various corrections and different experimental conditions are taken into consideration. Curves show the variation of k over the target area, with take-off angle, and with voltage; the form of the voltage variation agrees with the results of Guinier (Abstr. 3735/1953). A.

537.531 : 535.343

7069. ABSORPTION SPECTRUM OF LEAD. A.Ganson.
C.R. Acad. Sci. (Paris), Vol. 246, No. 24, 3337-8 (June 16, 1958).
In French.

The L absorption spectrum of lead was measured using especially pure specimens in the form of an evaporated thin film, several microns thick. The measured positions of the absorption edges differ by some ten X-units from previous measurements.
A.E.I. Research Laboratory

537.531 : 535.323

7070. A SIMPLIFICATION OF THE PRISM METHOD FOR DETERMINING THE REFRACTIVE INDEX FOR X-RAYS. W.Hink and W.Petzold.
Naturwissenschaften, Vol. 45, No. 5, 107-9 (1958). In German.

By using a microfocus X-ray tube, with a source size of one or two microns, the specific loading of the target can be increased considerably compared with a conventional tube. Using such a source the refractive index of a glass slab was determined for monochromatic copper $K\text{-}\alpha$ radiation. The deviation of the beam from its original path by a right-angle glass prism is recorded on a photographic plate. The arrangement enables an accuracy of 1% to be attained. T.Mulvey

537.531 : 535.43

7071. ENERGY AND ANGULAR DISTRIBUTION OF X-RAYS SCATTERED IN LEAD. J.H.Hubbell, E.Hayward and W.F.Titus.
Phys. Rev., Vol. 108, No. 6, 1361-7 (Dec. 15, 1957).

The energy and angular distributions of the photons transmitted by thick lead barriers irradiated by 8 and 10 MeV bremsstrahlung beams were measured by using a NaI(Tl) spectrometer. These distributions were integrated over angle. The resultant energy distributions, after subtraction of the calculated annihilation radiation component, were compared with the results of moments-method infinite-medium theory for plane monodirectional sources. Discrepancies of the order of 10% above 1 MeV and of the order of 50% below 1 MeV may be attributed, respectively, to omission of bremsstrahlung from the theory and the presence of a boundary in the experiment. An angular distribution of the transmitted energy indicated a nearly exponential fall-off with angle. A.

537.531 : 535.33.07

7072. COMPACT CURVED-CRYSTAL X-RAY SPECTROMETER. L.S.Birks, E.J.Brooks and G.W.Gourlay.
Rev. sci. Instrum., Vol. 29, No. 5, 425-6 (May, 1958).

The instrument was designed with all the mechanism, except the crystal and detector arms, contained in a box $6 \times 7 \times 3\frac{1}{2}$ in. Three sets of arms are provided for focusing circles of 10, 20 and 40 cm radius. Either automatic drive at from $\frac{1}{2}^\circ$ to 8° 2θ per min or manual scanning may be used. Precision-cut commercial gears result in accurate positioning and less than 0.01° 2θ backlash in the drive mechanism. Thus the spectrometer is satisfactory for use with rather perfect crystals such as quartz as well as with the alkali halides. Interchange of crystals and alignment of new crystals is simple and rapid. A.

537.531 : 535.3

7073. A VACUUM X-RAY SPECTROGRAPH WITH A GEIGER COUNTER FOR THE INVESTIGATION OF ENERGY LEVELS IN SOLID BODIES. A.P.Lukirskiĭ.
Radiotekhnika i Elektronika, Vol. 2, No. 3, 328-33 (1957).
In Russian.

A vacuum spectrograph for soft X-rays (20-100 A) is described using a curved diffraction grating. A Geiger counter is employed as the detector. This necessitates the use of a thin window and a gas handling arrangement to fill the counter after pumping down the spectrometer. The advantage of the method is the great sensitivity of the Geiger counter compared with electron multipliers or photographic plates. T.Mulvey

537.531 : 539.2

7074. SOLID STATE SPECTROSCOPY OF METALS AND ALLOYS AS A MEANS OF STUDYING THE ELECTRON STRUCTURE OF THEIR CONDUCTIVITY BAND. M.D.Borȳsov and A.M.Fefer.
Ukrayin. fiz. Zh., Vol. 2, No. 2, 122-36 (1957). In Ukrainian.

A large aperture spectrograph was used for studying, over a wide temperature range, the structure of K_{β_5} bands of Cr, Fe, Co, Ni, Cu pure metals and for Co—Ni—Cu alloys. It is shown that from a study of the middle region of the X-ray spectrum it is possible to predict the fine structure of X-ray emission bands.
C.R.S.Manders

537.531 : 535.33

7075. THE ORIGIN OF SATELLITES IN X-RAY SPECTRA. S.M.Karal'nik and S.B.Nyzhnyk.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 333-7 (1957). In Ukrainian.

A satellite is considered from the point of view of so-called external screening, taking the iron X-ray K spectrum as an example. It appears that a unified approach in accounting for satellites is possible. C.R.S.Manders

537.531

7076. AN X-RAY TUBE WITH A WATER-COOLED ROTATING ANODE FOR FINE-STRUCTURE WORK.
G.Becherer, O.Brümmer and D.Rienäcker.
Z. angew. Phys., Vol. 9, No. 3, 133-7 (March, 1958). In German.

The advantages of a small X-ray source of high intensity are pointed out and a demountable tube is described having a spot width

of about 0.4 mm. This is obtained by a demagnifying system consisting of two magnetic lenses. The maximum power input is 2.5 kW, the heat being conducted away by a water-cooled rotating anode. Copper or chromium radiation is available. T.Mulvey

537.531.07

7077. DEVELOPMENT OF A SCINTILLATION DOSIMETER FOR X-RAYS. H.U.Radtke.
Z. angew. Phys., Vol. 9, No. 4, 180-3 (April, 1957). In German.

A thin disk (0.05 g/cm^2) of air-equivalent compressed sodium salicylate is used as the detecting phosphor with a photomultiplier (RCA1 P21), the current output of which indicates the dose rate. Over the wavelength range 30-200 kV, the calibration factor is constant to ±3% and the lowest dose rate measurable is 1 x 10^{-5} r/sec. Results are given of the efficiency dependence on wavelength and phosphor thickness. J.R.Mallard

537.531.07 : 539.166.07

A VERSATILE INSTRUMENT FOR THE MEASUREMENT OF RADIATION DOSES. See Abstr. 6275

537.531.7 : 539.166.75

7078. A NOTE ON THE ELECTRONIC ATTENUATION COEFFICIENTS FOR SOME LOW Z ABSORBERS.
J.L.Bergsteinsson, L.B.Robinson, A.K.M.Siddiq, R.J.Horsley and R.N.H.Haslam.
Canad. J. Phys., Vol. 36, No. 1, 140-3 (Jan., 1958).

X-ray attenuation coefficients were measured for several low Z absorbers in the energy range 10-25 MeV using the method of "nuclear detectors" previously described (Abstr. 5042/1953). Experiments in the energy region where nuclear absorption is negligible are reported to indicate that the electronic absorption coefficients presented by Grodstein (Abstr. 9229/1957) yield better agreement for low Z absorbers than earlier tables but still appear rather too low. The corrected electronic absorption coefficients are used at higher energies to obtain the nuclear contribution to the absorption. L.L.Green

537.531.7

7079. TAKING ACCOUNT OF COHERENT SCATTERING IN CALCULATING THE EFFECTIVE X-RAY BEAM ENERGY.
R.Glocker and D.Messner.
Z. Phys., Vol. 149, No. 4, 480-5 (1957). In German.

In calculating the X-ray energy truly absorbed in a body it is usual to calculate the photoelectric absorption coefficient by subtracting the calculated Compton scattering coefficient from experimental values of the total mass absorption coefficient. The authors point out that it is also necessary to take account of coherent scattering. Their experimental results with anthracene and zinc sulphide are in good agreement with the values calculated by White. T.Mulvey

CATHODE RAYS. POSITIVE RAYS

537.533

7080. ANALYSIS OF MULTIVELOCITY ELECTRON BEAMS BY THE DENSITY-FUNCTION METHOD. A.E.Siegman.
J. appl. Phys., Vol. 28, No. 10, 1132-8 (Oct., 1957).

Some mathematical techniques are presented which assist in the analysis of one-dimensional multi-velocity accelerated electron streams by the density-function method. These techniques include methods for removing mathematical singularities from the equations. The correspondence between the density-function method and the usual single-velocity analysis is discussed; and a new definition of the equivalent a.c. voltage in terms of the density function is given. This definition is meaningful even for large velocity spread. The density-function method and the single-velocity theory agree for small velocity spread; while for a strongly multi-velocity beam, no simple transmission-line type of equations are to be found. Because of the latter fact, a common assumption about the noise conservation properties of the low-voltage region of an electron gun is not valid; and the beam's "noisiness" is not invariant with distance in this region. See also following abstract. A.

537.533

7081. DENSITY-FUNCTION CALCULATIONS OF NOISE PROPAGATION ON AN ACCELERATED MULTIVELOCITY ELECTRON BEAM.
A.E.Siegman, D.A.Watkins and Hsung-Cheng Hsieh
J. appl. Phys., Vol. 28, No. 10, 1138-48 (Oct., 1957).

The propagation of noise current and voltage fluctuations through the multi-velocity accelerating region immediately in front of the potential minimum was calculated using the density-function method of analysis. The basic assumptions made include: (a) linearized one-dimensional analysis; (b) zero total a.c. current in the beam; (c) uncorrelated full shot-noise in each velocity class at the minimum plane; (d) d.c. potential $\eta(\xi)$ given by the Fry—Langmuir analysis. Starting at the minimum, the noise fluctuations were traced out towards positive ξ by a numerical forward-integration process using an I.B.M. 650 computer. Principal results of the computations are that Haus's noise parameters S and Π are found to vary significantly with distance between $\eta = 0$ and $\eta = 4$, contrary to previous assumption. The noise parameter S decreases to ~0.7 of its initial value of $kT_c/2\pi$, while the noise power Π rises from zero to ~0.3 of the initial value of S. Exact results depend slightly on frequency. Beyond $\eta = 4$ both noise parameters become invariant. The theoretical minimum noise figure of a beam type microwave amplifier, which is $F_{min} = 1 + (2\pi/kT)(S - \Pi)$, is thus found to be reduced to ~$3\frac{1}{2}$ dB for a temperature-limited cathode instead of the commonly-quoted value of $6\frac{1}{2}$ dB which is based on the values of S and Π at the cathode. A.

537.533 : 538.3 : 621.385.833

7082. MAGNETIC FORCES AND RELATIVISTIC SPEEDS IN STATIONARY ELECTRON BEAMS. B.Meltzer.
J. Electronics and Control, Vol. 4, No. 4, 350-4 (April, 1958).

The assumption usually made that self-magnetic forces may be neglected in non-relativistic electron beams is shown to be unjustified in general. As an example, it is proved that Child-Langmuir space-charge-limited flow between infinite parallel planes is impossible. If one starts with a thin beam section of such flow, as produced for example in a Pierce gun, and broadens it indefinitely, the magnetic attraction of the current filaments will increase without limit and constrict the beam. The limitation on beam size for magnetic constriction to be negligible is $r/a \ll 6c^2/v^2$, where r is beam radius, a diode spacing, v maximum electron speed and c speed of light. The limitation on size for relativistic beams is also calculated, use being made of Acton's analysis of relativistic diodes (Abstr. 8682A/1957) which also neglected magnetic forces. For planar diodes of potentials 51 kV, 511 kV and 5.11 MV, the restrictions required are respectively $r/a \ll 29$, 5.6 and 1.1. B.Meltzer

537.533 : 621.385.833

7083. SUFFICIENT AND NECESSARY TRAJECTORY CONDITIONS FOR DENSE ELECTRON BEAMS. B.Meltzer and A.R.Lucas.
J. Electronics and Control, Vol. 4, No. 5, 454-6 (May, 1958).

A pair of sufficient conditions were given by Lucas et al. (Abstr. 3174B/1958, J. Electronics and Control, Vol. 4, No. 2, 160-4, Feb., 1958) for a given set of trajectories to be possible ones in a laminar, irrotational, electrostatic, non-relativistic beam; it is now shown that these conditions are not necessary, in spite of a contrary conjecture in the earlier paper. A new necessary condition is derived. See also following abstract. B.Meltzer

537.533 : 621.385.833

7084. COMMENTS ON "A GENERAL THEOREM FOR DENSE ELECTRON BEAMS" BY A.R.LUCAS, B.MELTZER, AND G.A.STUART. P.T.Kirstein.
J. Electronics and Control, Vol. 4, No. 5, 457-9 (May, 1958).

Two new solutions of the equations of electrostatic, non-relativistic stationary space-charge flow are given as counter-examples to refute the conjecture of Lucas et al. (see preceding abstract) that their two general sufficient conditions are also necessary ones for such flows. B.Meltzer

537.533 : 537.222

7085. A PERTURBATION ANALYSIS OF THE EQUATIONS FOR ELECTROSTATIC SPACE-CHARGE FLOW AND ITS APPLICATION TO THE PRODUCTION OF HOLLOW BEAMS FROM A TOROIDAL CATHODE. P.T.Kirstein.
J. Electronics and Control, Vol. 5, No. 1, 33-53 (July, 1958).

A perturbation theory for electrostatic space-charge flow is developed. The theory admits perturbations both of the physical parameter of flow and of the metric in which they are derived (allowing for perturbations of the cathode). As an illustration of the method, the problem of the production of a hollow beam from a toroidal cathode is treated as a perturbation of the problem of the production of a strip-beam from a circular cathode. A.

537.533

7086. OSCILLATION DAMPING IN A CYCLIC ELECTRON ACCELERATOR. Yu.F.Orlov and E.K.Tarasov.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 651-7 (1958). In Russian.

Characteristics of damping of radial and phase oscillations are

derived taking into account variation of the magnetic field along the orbit. In a strong-focusing accelerator, in contrast to a weak-focusing accelerator, damping is independent of variation of the gradient $\partial H_z/\partial r$ along the orbit, providing that the field strength H_z is the same in all magnets. A.

537.533

7087. TRANSIENT CIRCULATING CURRENT AT THE TIME OF INJECTION OF ELECTRONS INTO A BETATRON.
V.N.Logunov, E.P.Ovchinnikov, V.D.Rusanov and S.S.Semenov.
Zh. tekh. Fiz., Vol. 27, No. 5, 1143-8 (1957). In Russian.

A 30 MeV betatron-started electron-synchrotron was used with auxiliary electronic apparatus, a detailed circuit diagram of which is given. The method was based on Kerst's (Abstr. 2184/1941) induction method and the dependence of the circulating current on both the time and the variation of the amplitude of the injection-pulse was investigated. It was found that the transition coefficient from transient into uniform current increases with the injection current and reaches 0.3 to 0.4 at optimum conditions. J.M.Zarzycki

537.533

7088. THE CAPTURE OF PARTICLES IN THE SYNCHRO-PHASATRON MODE OF ACCELERATION.
I.S.Danilkin and M.S.Rabinovich.
Zh. tekh. Fiz., Vol. 28, No. 2, 351-64 (1958). In Russian.

An analytical study of the capture of injected particles into stable orbits of a synchrophasatron. The processes occurring in this stage of the acceleration are analysed, and the results compared with experimental data. G.Martelli

537.533 : 537.534

7089. THE EIGENFUNCTIONS OF THE EQUATION OF FREE OSCILLATIONS IN A WEAK-FOCUSING ACCELERATOR WITH SECTIONAL MAGNET, AND THEIR APPLICATIONS.
V.I.Kotov and N.B.Rubin.
Zh. tekh. Fiz., Vol. 28, No. 2, 365-79 (1958). In Russian.

An analytical expression for the eigenfunctions of the equations of free oscillations (betatron oscillations) in a weak-focusing accelerator with straight sections is obtained and the properties of these eigenfunctions investigated. The influence is investigated of (a) the distortion of the vertical component of the magnetic field and of the median magnetic plane on the free oscillations in absence of resonance, and (b) the behaviour of the oscillations near a given resonance, by developing the perturbations in a series of eigenfunctions. The same method is applied to study the parametric resonance and the coupling between free vertical and radial oscillations.

G.Martelli

537.533 : 537.534

7090. ACCELERATORS WITH RADIALLY INCREASING FIELDS AND ADDITIONAL ELECTRON-OPTICAL ELEMENTS FOR VERTICAL FOCUSING OF THE BEAM.
V.M.Kel'man, B.P.Peregud and K.A.Dolmatova.
Zh. tekh. Fiz., Vol. 28, No. 5, 1056-64 (1958). In Russian.

A method is proposed for producing a focused beam of particles using a radially increasing guiding field. The beam is focused by magnetic cylindrical lenses. Radial and vertical stability is obtained. The method may be applied to a wide variety of cycled accelerators. A model for testing the method is described.

T.Mulvey

537.533 : 537.534

7091. INVESTIGATION OF THE STABILITY OF THE MOTION OF PARTICLES IN ACCELERATORS WITH RADIALLY INCREASING FIELDS AND AUXILIARY SYSTEMS FOR PRODUCING FOCUSING IN A BEAM OF PARTICLES. Yu.V.Vandakurov.
Zh. tekh. Fiz., Vol. 28, No. 5, 1065-76 (1958). In Russian.

Expressions are obtained for the trajectories of particles in this type of accelerator; from these the stability conditions are deduced, and the minimum current requirement for the focusing coils is determined. T.Mulvey

537.533 : 538.122.08 : 621.384.6 : 621.317.42

MEASUREMENT OF THE FIELD OF MAGNETS OF ACCELERATORS WITH STRONG FOCUSING. See Abstr. 6032

537.533 : 537.534

7092. THE APPLICATION OF POWER RECUPERATION IN LINEAR ACCELERATORS. L.O.Dushin and M.A.Khyzhnyak.
Ukrayin. fiz. Zh., Vol. 2, No. 2, 106-13 (1957) In Ukrainian.

High-frequency power-recuperation is shown theoretically to be worth while. An experimental layout, using a ring waveguide bridge and a small linear accelerator (0.7 MeV), for verifying the facts experimentally at low and high powers, is described, together with some of the results obtained. These appear to be in good accord with theory. C.R.S.Manders

537.533 : 537.534

7093. FOCUSING IN A LINEAR ACCELERATOR BY MEANS OF TRAVELLING WAVES. V.S.Tkalich.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 299-302 (1957). In Ukrainian.

Theoretical. Discusses focusing with two travelling-waves of different phase-velocities. The case of focusing with a travelling-wave in a spiral waveguide accelerator is considered as an example. C.R.S.Manders

537.533 : 538.566 : 621.372.81

7094. ELECTRON WAVES IN PERIODIC STRUCTURES.
L.A.Vaĭnshteĭn.
Zh. tekh. Fiz., Vol. 27, No. 10, 2340-52 (1957). In Russian.

Electron-waves in periodic structures are studied in the light of the theory of the excitation of periodic waveguide structures and the method of variations. Relationships previously obtained for "smooth" slow-wave structures are extended to periodic systems, and in particular a characteristic equation is derived for calculating the properties of travelling-wave tubes and backward-wave tubes.

537.533 : 538.566 : 621.372.81

7095. ON SPATIAL HARMONICS AND WAVE MODES IN A PERIODIC WAVEGUIDE. G.L.Suchkin.
Zh. tekh. Fiz., Vol. 28, No. 5, 1126-7 (1958). In Russian.

Refers to a previous paper (see preceding abstract) in which the excitation of a periodic waveguide by probes was discussed. In it the periodic structure was presented in terms of isotropic ϵ and μ, postulating that the relations obtained adequately describe wave modes in a near-periodic system filled with a homogeneous medium. From the requirement of the invariance of solutions of Maxwell's equations it follows, however, that the smoothing of periodic boundaries can be achieved only by introducing an inhomogeneous anisotropic medium. Hence, the aforementioned investigation of the periodic waveguide is, in a sense, a first approximation to a solution of a more complex problem of an anisotropic periodic waveguide. Z.F.Voyner

537.533 : 537.534

7096. THE MICROTRON AS A HIGH-ENERGY, HIGH CURRENT PARTICLE ACCELERATOR. A.Roberts.
Ann. Phys. (New York), Vol. 4, No. 2, 115-65 (June, 1958).

It is proposed that the conventional electron microtron may be converted into a high-energy accelerator for protons or electrons in the BeV range, and capable of very high currents. It would require a high-energy injector, e.g., an F.F.A.G. cyclotron, capable of supplying protons of energy above 500 MeV in a beam of high intensity and high quality. The changes required are the introduction of Thomas focusing (sector fields), the use of linacs for acceleration, and the use of high-energy injection. The resulting accelerator uses fixed (and sometimes even uniform) magnetic fields, a fixed frequency r.f. accelerating system with wavelength near 20 cm, and may be designed in one stage or in a cascade of two or more stages, each using a separate linac, with contiguous fields. It is capable of reaching arbitrarily high energies without betatron resonance difficulties, it possesses phase stability, and it provides a beam, remarkably homogeneous in energy, which may be easily and completely extracted from the machine, since successive orbits are well separated. The problems of orbit dynamics, linac design, betatron and phase oscillations, and cascade operation are discussed, and sample designs for a 3 BeV proton accelerator are given. The theory of synchronism in nonzero-gradient fields is presented. An analytic theory of phase oscillation is given. The name "auxinotron" is proposed for the new type of accelerator. A.

537.533

7097. THE MICROTRON. D.Aitken and R.E.Jennings.
Nature (London), Vol. 181, 1726 (June 21, 1958).

This machine is now operating, giving a mean electron current of 10^{-9} A at an energy of 28 MeV. It is hoped to develop a modified cavity resonator, so that the machine may be used at fields greater than the present 1000 Oe. The machine will be used to study bremsstrahlung spectra and energy loss of electrons in various materials. D.H.Lord

537.533.2 : 537.312.5

7098. ACTIVATION OF SILVER–MAGNESIUM AND COPPER–BERYLLIUM DYNODES. A.H.Sommer.
J. appl. Phys., Vol. 29, No. 3, 598-9 (March, 1958).

It has been found that, as with Ag–Mn, Be–Cu dynodes are best activated as secondary emitters by oxidation in water vapour or CO_2

rather than by O_2. This is thought to be because the large H_2O molecules only oxidize surface Be, thus producing a continuous BeO surface layer. Oxygen on the other hand penetrates the material and also oxidizes copper, as evidenced by the observed blackening. A.H.W.Beck

537.533.2 : 541.183 : 539.18

7099. ELECTRICAL PROPERTIES OF NITROGEN ADSORBED ON TUNGSTEN. J.Eisinger.
J. chem. Phys., Vol. 28, No. 1, 165-6 (Jan., 1958).

The work function Φ for tungsten was measured photoelectrically and the dependence of Φ on the concentration of adsorbed nitrogen atoms determined at equilibrium pressures of 5.6×10^{-9} and 5.7×10^{-7} mm Hg. The effective electric dipole moment of a nitrogen atom adsorbed on tungsten is calculated. G.I.W.Llewelyn

537.533.2

7100. THE EFFECT OF AN ADSORBED FILM OF Ba ATOMS AND OF MOLECULES OF BaO ON THE WORK FUNCTION OF AN ELECTRON FROM A METAL. V.M.Havrylyuk.
Ukrayin. fiz. Zh., Vol. 1, No. 1, 73-80 (1956). In Ukrainian, with summary (1 p.) in Russian.

Gives the results of measurements of the work functions for electrons drawn from W and Au carrying films of Ba or BaO. The variation of the work function for the Ba–W system, namely $\varphi = \varphi_W - \Delta\varphi$ (where $\varphi_W = 4.5$ eV), is plotted against concentration of adsorbed atoms $n - \varphi(n)$ over a range of surface concentrations $0 < n < 7.5 \times 10^{14}$ cm^{-2}. This curve has a minimum for $n \approx 4 \times 10^{14}$ cm^{-2}. For Ba–Au there are indications of a different adsorption mechanism than for Ba–W. There is some diminution of the work function with adsorption of Ba atoms.

C.R.S.Manders

537.533.2

7101. CHANGE OF WORK FUNCTION OF A METAL WITH ADSORPTION ON THE SURFACE OF DIPOLE MOLECULES. I.M.Dykman.
Ukrayin. fiz. Zh., Vol. 1, No. 1, 81-7 (1956). In Ukrainian, with summary (1 p.) in Russian.

It is shown that lowering of the work function can occur even in the case where the metal to molecule bond is not a chemical one, i.e. if no appreciable electron exchange takes place. Limiting cases are considered here which enable a considerable simplification to be made in the formulae derived. Criteria of applicability of the simplified formulae are also given and examples worked for BaO on W and for CsCl on W. Change of work function v. surface concentration gives a curve with a maximum. C.R.S.Manders

537.533.2

7102. CONFERENCE ON CATHODE ELECTRONICS. Yu.H.Ptushynskyi.
Ukrayin. fiz. Zh., Vol. 1, No. 2, 204-6 (1956). In Ukrainian.

Report on a conference which took place 25-29 August 1955 at the Institute of Physics of the Ukrainian Academy of Sciences, Kiev. The organizing departments were of Radio and Radiophysics of the Physico-Mathematical Divisions of the Academy of Sciences of the U.S.S.R. and the Ukrainian Academy of Sciences. A.A.Lebedev, Academician, presided. The meetins were organized as under: (i) Thermoelectric emission — opening address by B.M.Tsar'ov, 15 other contributions. (ii) Field emission — opening address by D.V.Zernov, 3 other papers. (iii) Secondary electron emission — opening address by L.M.Dobretsov, 8 other papers. (iv) Photoelectric emission — opening address by P.V.Timofeev, 19 other papers. The material communicated will appear in other journals. C.R.S.Manders

537.533.2

7103. THE EFFECT OF ADSORPTION OF A LAYER OF THE PRODUCTS OF VAPORIZATION OF BaO FROM PLATINUM ON THE WORK FUNCTION OF ELECTRONS FROM GERMANIUM. P.H.Borzyak and O.H.Sarbei.
Ukrayin. fiz. Zh., Vol. 1, No. 4, 395-402 (1956). In Ukrainian, with summary (1½ pp.) in Russian.

The apparatus for depositing the material and for carrying out the measurements is illustrated. By observing the change of contact potential with deposition of the active layer on a Ge single crystal the maximum change of thermoelectric work-function was found viz. 2.6 eV. It is concluded that in the general case of adsorption of active layers the contact potential of a semiconductor must be changed firstly as a consequence of change of surface charge, and secondly, on account of double layer formation. With sufficiently active layers and semiconductors with large so-called "internal work-function" the action of the double layer can overwhelmingly dominate the change of surface charge action, as happens in the present case. C.R.S.Manders

537.533.2

7104. THE EMISSION OF NEGATIVE IONS DUE TO THE EFFECT OF CHLORINE MOLECULES ON CAESIUM SURFACES. K.Rührdanz and K.Ulmer.
Z. Phys., Vol. 149, No. 4, 432-4 (1957). In German.

Negative ions are emitted as well as electrons from evaporated caesium layers exposed to chlorine. They are identified as molecular chlorine ions of about 0.2 eV energy and comprise about 25% of the emission. G.F.J.Garlick

537.533.2

7105. THE SECONDARY ELECTRON EMISSION OF NICKEL. A.R.Shul'man, I.R.Zakirova, Yu.A.Morozov and S.A.Fridrikhov.
Zh. tekh. Fiz., Vol. 28, No. 1, 87-96 (1958). In Russian.

The spherical condenser method was used; measurements were made using primary voltages, V_p, up to 2 kV; the temperature of the Ni was 450° C. Particular attention was paid to the spectrum of secondary electrons at small energies and at energies close to that of the primary beam. An "antidynatron" grid was used to eliminate the effect of secondaries emitted from the collector. The results at low secondary energies differ slightly from earlier ones. About 30% of the secondaries had energies greater than 100 eV for $V_p = 1600$ V. For $V_p > 800$ V, elastically reflected primaries made up ~ 2% of the total secondary current.

K.F.Hulme

537.533.3 : 621.385.833

7106. FOCUSING IN HIGH-VOLTAGE BEAM-TYPE ELECTRON DEVICES. S.V.Yadavalli.
J. Electronics and Control, Vol. 5, No. 1, 65-87 (July, 1958).

The paraxial electron-trajectory equation applicable at relativistic speeds, including the effects of self-magnetic field and space-charge of the beam, is derived. Problems concerning beam spreading, electrostatic lenses (the unipotential Pierce gun being an example), magnetic lenses, Brillouin flow and beam stability are treated using this equation. Most of the results are presented graphically and discussed in detail. Their applications to practical situations is indicated. A.

537.533.3

7107. GRAPHO-ANALYTICAL CONSTRUCTIONS OF TRAJECTORIES OF CHARGED PARTICLES IN MAGNETIC FIELDS. N.I.Shtepa.
Radiotekhnika i Elektronika, Vol. 2, No. 6, 790-5 (1957). In Russian.

Two methods of constructing trajectories of relativistic charged particles are described: the method of velocity increments and the method of radii of curvature. An example illustrating the use of both methods is given. Z.Krasucki

537.533.3

7108. ON THE THEORY OF ABERRATIONS IN ELECTRON-OPTIC FOCUSING SYSTEMS WITH A CURVILINEAR AXIS. Yu.V.Vandakurov.
Zh. tekh. Fiz., Vol. 27, No. 8, 1850-62 (1957). In Russian. English translation in: Soviet Physics — Technical Physics (New York), Vol. 2, No. 8, 1719-33 (Aug., 1957).

The method of trajectories is applied to derive equations which may be used to compute the second- and third-order geometric aberrations and the first- and second-order chromatic aberrations in the case of arbitrary electric and magnetic fields. Formulae are derived for the above aberrations and for the mass and velocity dispersions. Conditions are found under which geometric aberrations of the second-order are absent. All derivations of the general formulae are performed for the relativistic case. A.

537.533.33

7109. ON THE CONDITIONS FOR THE EXISTENCE OF STIGMATIC IMAGING IN ELECTRON OPTICAL SYSTEMS WITH CURVED AXES. P.P.Kas'yankov.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 3, 497-500 (1958). In Russian.

Conditions for stigmatic imaging in electron optical systems with curved axes are derived and applied to the correction of electron lenses with elliptical bores. A.E.I. Research Laboratory

537.533.35

7110. THE IMAGE OF A SURFACE OBTAINED WITH NEGATIVE IONS. R.Bernard and R.Goutte.
C.R. Acad. Sci. (Paris), Vol. 246, No. 18, 2597-9 (May 5, 1958). In French.

An emission microscope is described using negative ions, released by bombarding the surface with positive ions. The second-

ary electrons produced by the bombardment are removed by a magnetic deflector. The resolution of the system is 2 μ.

A.E.I. Research Laboratory

537.533.35

7111. ON THE POSSIBILITIES OF INCREASING THE RESOLUTION OF THE EMISSION MICROSCOPE WITH THE AID OF AN ELECTRON MIRROR. Yu.V.Vorob'ev.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 4, 751-2 (1958). In Russian.

The author suggests that the resolving power of the electron emission microscope might be improved considerably by placing an electron mirror after the final projection lens, so as to filter out those electrons with high thermal energy. T.Mulvey

537.533.35

7112. EMISSION MICROSCOPY WITH SECONDARY ELECTRONS (15 keV PRIMARY ELECTRONS). W.Bayh.
Z. Phys., Vol. 150, No. 1, 10-15 (1958). In German.

The microscope for surface investigation, in which ion bombardment produced secondary electrons (Abstr. 6841/1953), has been modified by replacing the ion source by an electron gun. A beam of 15 keV electrons ejects secondary electrons from the surface, which are focused by a high-power electrostatic immersion objective at a magnification up to 850×. With a small aperture (usually 15 μ) in the focal plane of the objective, a resolving power of 1000 A was obtained instead of 500 A with ion bombardment. Differentiation between various materials was also less good, but on the other hand there is much less sputtering of the specimen. V.E.Cosslett

537.533.35 : 539.165

7113. A MAGNETIC PRISM β-SPECTROMETER WITH SCINTILLATION ELECTRON COUNTER.
I.F.Barchuk and H.V.Belykh.
Ukrayin. fiz. Zh., Vol. 1, No. 1, 98-105 (1956). In Ukrainian, with summary ($\frac{1}{2}$ p.) in Russian.

Describes, with constructional diagrams, the lay-out of a magnetic prism β-spectrometer with axial-symmetrical field. The recording of the electrons is done by means of an anthracene crystal scintillation counter and photomultiplier. Expressions are derived suitable for the practical calculations of electron trajectories. The resolving power of the instrument is ~1% and the light intensity obtainable about twice that of the Danysz spectrometer.

C.R.S.Manders

537.533.7

7114. ELECTRON ABSORPTION OF THIN METAL FILMS IN THE ELECTRON MICROSCOPE. L.Reimer.
Z. angew. Phys., Vol. 9, No. 1, 34-8 (Jan., 1957). In German.

The reduction of intensity of a beam of electrons in passing through a thin metal film is exponential in character provided that the structure is extremely fine. Nickel, manganese, and aluminium films satisfy this condition. Films with large crystal structures depart from this law because of Bragg reflections and irregularities in thickness. T.Mulvey

537.533.71

REFLECTION OF VERY SLOW ELECTRONS. See Abstr. 5935

537.533.75

7115. RETARDATION OF ELECTRONS IN CERTAIN METALS AND SEMICONDUCTORS. A.Ya.Vyat-skin and A.F.Makhov.
Zh. tekh. Fiz., Vol. 28, No. 4, 740-7 (1958). In Russian.

Retardation of 0-18 keV electrons was investigated by measuring the electron transmission of thin (100-1840 mμ), unsupported layers of Ge, Cu, Si and Bi. Graphs showing the current passing through a layer of a given thickness as a function of the electron energy E were constructed. Extrapolation of these graphs to the E-axis gave the E values corresponding to the electron path length D (thickness of the investigated layer). From these data the law of electron retardation was formulated, which for all four elements had the same form $D = CE^{1.4}$, with C = 27.0, 18.5, 42.5 and 16.5 for Ge, Cu, Si and Bi, respectively. M.H.Sloboda

537.533.8 : 537.312.5 : 621.383

THE DISTRIBUTION OF ELECTRON ENERGIES FROM ANTIMONY–CAESIUM CATHODES. See Abstr. 7024

537.533.9 : 539.19

7116. QUANTUM PHENOMENA IN THE RADIOFREQUENCY RANGE. V.M.Faĭn.
Uspekhi fiz. Nauk, Vol. 64, No. 2, 273-313 (1957). In Russian.

The first half of the paper is concerned with quantum phenomena in radioelectronics, i.e. the mutual interaction of free electrons with h.f. fields. The second half discusses radiospectroscopy problems associated with the possibility of setting up coherent states in a system of molecules. C.R.S.Manders

537.534

7117. THE DEVELOPMENT OF AN ELECTROSTATIC ACCELERATOR IN A COMPRESSED GAS AND THE INVESTIGATION OF CERTAIN PROCESSES DETERMINING ITS BASIC PARAMETERS.
H.S.Kryshtab.
Ukrayin. fiz. Zh., Vol. 1, No. 4, 312-22 (1956). In Ukrainian, with summary ($\frac{1}{2}$ p.) in Russian.

The accelerator works at 2.5 MeV in compressed nitrogen and is used as a neutron source. The ion source, using electron oscillations in a magnetic field, gives, in the conditions quoted above, 200 μA of ions for gas expenditure 3.5 cm^3/hr. Focusing is by a method suggested by Elkind and the calculated performance is accurately borne out. Electrodes are funnel-shaped. The retardation radiation occurring in the accelerator tube is of considerable intensity and rises steeply with increase of applied tension, corresponding qualitatively to a retardation of electrons with energies 2.5 times less than the energy of the accelerated ions. C.R.S.Manders

537.534

7118. EXTRACTION MEASUREMENTS AND BEAM GUIDANCE WITH AN ARC SOURCE. M.Wutz.
Z. angew. Phys., Vol. 8, No. 12, 596-8 (Dec., 1956). In German.

Positive ion extraction from an argon arc source of the type Tuve, Dahl and Halfstadt (Abstr. 3969/1935) is described for use with a linear accelerator. An optimum beam current of 2 mA is registered. For pressures greater than 3×10^{-3} mm Hg a strong decrease in beam current is noted, whilst for pressures less than this, the total current, which includes that to the probe, is pressure independent and obeys a $\frac{2}{3}$ power law as regards the probe voltage. The beam is guided over a distance of 50 cm by means of an electric system consisting of eight lenses at 21kV and a current of 700 μA emerges. A.E.D.Heylen

537.534.1 : 539.18

7119. ON THE MOTION OF IONS IN A MIXTURE OF ISOTOPES.
Yu.M.Kagan and V.I.Perel'.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 126-8 (1958). In Russian.

Expressions for the drift velocity of ions of isotopes in a mixture of isotopes are derived. The primary interaction process between the ions and atoms is assumed to be of pure charge-exchange nature. A.

537.534.3

7120. A SIMPLE MASS SPECTROSCOPE OF HIGH SENSITIVITY WITH STIGMATIC DIRECTIONAL FOCUSING.
E.Schönheit.
Z. angew. Phys., Vol. 9, No. 4, 171-80 (April, 1957). In German.

Most simple mass spectrometers are astigmatic, i.e. they produce a line focus. Most point focusing mass spectrometers are of the double focusing type giving high resolution but are costly to make. The present paper describes a simple spectrograph using a point focusing system with a single stage of magnetic deflection, for use in the study of photo-ionization in gases. T.Mulvey

537.534.3

7121. THEORY OF AN ELECTRICAL HIGH-FREQUENCY MASS-SPECTROMETER. G.Falk and F.Schwering.
Z. angew. Phys., Vol. 9, No. 6, 272-5 (June, 1957). In German.

Treats the resolving power of an ion mass-spectrometer, which uses the resonance between an a.c. electric field superposed on the d.c. field of a cylindrical condenser, and the mass-dependent oscillations around stable spiral orbits of ions with initial axial velocity components inside the condenser. B.Meltzer

537.534.75

7122. ON THE RANGE–ENERGY RELATION OF Li^8 IONS IN NUCLEAR EMULSIONS. J.P.Lonchamp and G.Robin.
C.R. Acad. Sci. (Paris), Vol. 246, No. 5, 748-50 (Feb. 3, 1958). In French.

Li^8 ions from the bombardment of Be by 375 MeV α-particles were detected in C2 emulsions, and identified by their characteristic "hammer tracks". Nine points in the range 20-22 MeV confirmed the range–energy relation proposed by Lonchamp (Abstr. 8670/1957). E.J.Burge

537.534.9 : 548.574

FORMATION OF ORIENTED FIGURES BY IONIC BOMBARDMENT OF METALS. See Abstr. 6507

DISCHARGE TUBES. IONIZATION. THERMIONICS

537.542

7123. A SOURCE OF PROTONS FROM THE THERMAL DISSOCIATION OF WATER MOLECULES.
M.D.Habovÿch and Z.P.Fedorus.
Ukrayin.fiz. Zh., Vol. 1, No. 2, 158-69 (1956). In Ukrainian, with summary (1 p.) in Russian.

Describes a proton source combining the method of discharge, in a metal chamber (yielding 10-20% protons) with thermal dissociation brought about by heating of the metal walls of the vessel to 2200-2400°K. A proton content of as much as 85% may be achieved. A description is included of a mass-analyser for continuous observation of the proton content of the ion beam produced by the apparatus. An advantage of the design is that the method could be readily adapted for ions of refractory metals. C.R.S.Manders

537.542

7124. A HIGH FREQUENCY ION SOURCE. Yu.V.Hofman.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 373-4 (1957). In Ukrainian.

The constructional diagram and characteristic curve of the device are given. At optimum conditions a magnetic analysis shows the beam obtained to consist of 80% ions. For a beam-current of 250 μA the beam diameter may only be 0.5-1 mm.

C.R.S.Manders

537.543 : 621.385.2

7125. THE INITIAL STAGE OF THE PASSAGE OF CURRENT THROUGH A DIODE. S.A.Kuchaĭ.
Zh. tekh. Fiz., Vol. 28, No. 3, 498-9 (1958). In Russian.

General expressions for the transit-time of the basic electrons through a cylindrical or spherical diode, to which a constant-potential pulse has been applied, are derived for the case of continuous electron emission. M.H.Sloboda

537.56 : 621.387

7126. APPARATUS FOR PRODUCING PLASMA BEAMS.
E.R.Harrison and R.H.Dawton.
J. Electronics and Control, Vol. 5, No. 1, 29-32 (July, 1958).

A description is given of apparatus for producing a constricted discharge; this is followed by a brief account of one or two elementary experiments with discharges, or plasma beams, of this kind. The apparatus is simple and possesses the advantage that it has a number of useful applications; for example, it can be readily adapted to serve as an ion source. A.

537.56

7127. SUPERSONIC MOTION OF VACUUM SPARK PLASMAS ALONG MAGNETIC FIELDS.
D.Finkelstein, G.A.Sawyer and T.F.Stratton.
Phys. of Fluids, Vol. 1, No. 3, 188-92 (May-June, 1958).

The observations of principal interest concern the speed with which the plasmas leave the spark. The conclusions about plasma speeds are that they are approximately ten times greater than the thermal speeds associated with spark temperature, varying between 2×10^6 and 2×10^7 cm/sec, and in the range observed, the velocities are approximately independent of the spark parameters. It is suggested that the pinch effect may be the mechanism of plasma acceleration. A.

537.56

7128. THE FORMATION OF NEGATIVE HYDROGEN IONS DURING THE PASSAGE OF POSITIVE HYDROGEN IONS ACROSS A SUPERSONIC STREAM OF OIL VAPOURS.
Ya.M.Fogel', L.I.Krupnik and R.P.Slabospitskiĭ.
Zh. tekh. Fiz., Vol. 27, No. 5, 981-7 (1957). In Russian.

For previous work, see Abstr. 1412 (1957). Oil vapours of low vapour tension at room temperature were used as working substance. It is shown that I^-/I^+ increases with temperature and there is a maximum somewhat above room temperature. The maxima are higher for lower beam energies. C.R.S.Manders

537.562 : 535.338

TYPICAL STATES IN THE SPECTRA OF DENSE PLASMAS. See Abstr. 6823-4

537.562 : 621.387

7129. CERTAIN PHENOMENA OBSERVED DUE TO THE COUPLING BETWEEN AN OSCILLATOR AND AN IONIZED GAS TUBE INTRODUCED IN THE OSCILLATOR INDUCTANCE.
T.V.Ionescu and O.C.Gheorghiu.
C.R. Acad. Sci. (Paris), Vol. 246, No. 26, 3598-601 (June 30, 1958). In French.

If the frequency of an oscillator to which an ionized gas is tightly coupled is increased, sharp drops in grid current occur at frequencies near the natural frequencies of the negative ions of the gas. If the frequency is varied in the opposite sense the current assumes a value corresponding to the lowest oscillator frequencies. Variations in which the current increases sharply at the absorption frequencies are also observed. The behaviour of an ionized gas when coupled to a coil carrying a high-frequency current are investigated. R.C.Glass

537.562

7130. GASEOUS SPECIES IN THE VAPORIZATION OF SODIUM AND POTASSIUM HYDROXIDE. R.F.Porter and R.C.Schoonmaker.
J. chem. Phys., Vol. 28, No. 1, 168-9 (Jan., 1958).

The species effusing from a Knudsen cell containing a condensed hydroxide phase were subjected to electron bombardment for subsequent ion detection in a mass spectrometer. The major ions observed were M^+, MOH^+, and M_2OH^+ where M is either Na or K. The results indicate that M_2OH^+ must be formed by dissociative ionization of the (gaseous) dimer, $M_2(OH)_2$. The partial pressure of the latter is found by its relation to the ion current of M_2OH^+ and T. The usual Clausius–Clapeyron plots then give the heats of vaporization of the dimers. It is thought that KOH^+ is formed from $K_2(OH)_2$, $NaOH^+$ from NaOH(g), and M^+ largely from simple ionization of gaseous alkali metal. W.Good

537.562

7131. THE STATISTICS OF ELECTRON AVALANCHES IN UNIFORM FIELDS. II. L.Frommhold.
Z. Phys., Vol. 150, No. 2, 172-81 (1958). In German.

For Pt I see Abstr. 4467 (1956). A continuation of earlier work on the experimental investigation of the sizes of avalanches ("distribution functions") in Townsend discharges. Values of the ionization coefficient α can be deduced. Data are presented for oxygen, air and methane. Allowance for attachment is made in the two former gases. J.D.Craggs

537.562 : 536.461

IONS IN HYDROCARBON FLAMES. See Abstr. 6917

537.562.08

7132. EXPRESSION FOR THE CHARACTERISTIC OF A COLD PROBE IN AN IONIZED FIELD OF CYLINDRICAL SYMMETRY.
J.Dupuy.
C.R. Acad. Sci. (Paris), Vol. 246, No. 20, 2872-5 (May 19, 1958). In French.

Using electrostatic theory it is shown that with probes of very small radius, as used in practice, the error introduced by neglecting the non-uniformity of the field is very small. This is also valid for the case when there is counter-emission from the external cylinder. For counter-emission the experimental characteristic does not agree with the theoretical one, and it is thought that it is due to the probe casting a "shadow" on the wall of the external cylinder.

A.E.Kay

537.564 : 539.18

7133. IONIZATION OF FAST NEUTRAL POTASSIUM ATOMS IN COLLISIONS WITH ATOMS OF ARGON AND MOLECULES OF HYDROGEN, NITROGEN AND OXYGEN.
Yu.F.Bÿdin and A.M.Bukhteev.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 6, 1131-3 (1958). In Russian.

Ionization of potassium atoms of energy 100 to 200 eV in $K + A \rightarrow K^+ + e + A$ collisions is measured by recording the fast positive K^+-ions. G.E.Brown

537.564

7134. CROSS SECTIONS OF CERTAIN CHARGE TRANSFER REACTIONS. S.N.Ghosh and W.F.Sheridan.
J. chem. Phys., Vol. 27, No. 6, 1436-7 (Dec., 1957).

Continuation of previous work (Abstr. 5426/1957). Experimental curves of charge transfer cross-section v. ion energy, for energies in the range 100 to 800 eV, are given for positive ions of Cl_2, CO, NO, O_2 and CO_2 each in their own gas, for A^+ ions in CO, NO and CO_2, and for ions of CO and CO_2 in A. J.Dutton

537.564

7135. ASYMMETRIC CHARGE-EXCHANGE REACTIONS.
S.B.Karmohapatro and T.P.Das.
J. chem. Phys., Vol. 29, No. 1, 240-1 (July, 1958).

The cross-sections of these calculated by the use of a better wave-function are in much closer agreement with experiment than hitherto. W.Good

537.564

7136. RANGE AND SPECIFIC IONIZATION OF MULTI-CHARGED IONS IN GASES.
Ya.A.Teplova, V.S.Nikolaev, I.S.Dmitriev and L.N.Fateeva.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 559-68 (1958). In Russian.

The ranges and specific ionization in air, argon and hydrogen were measured for ions from Be to Ne possessing velocities between 1.5×10^8 to 12×10^8 cm/sec. For $v \leq 5.10^8$ cm/sec the specific ionization and ranges of the ions are approximately proportional to the particle velocity v. At higher velocities the ranges are proportional to v^3 and the specific ionization curves have a flat maximum as in the Bragg curve for α-particles. The stopping power of a substance is not the same for various ions and decreases with increase of Z of the ion. A.

537.564 : 539.18

7137. ELECTRON LOSS AND CAPTURE IN COLLISIONS BETWEEN FAST HYDROGEN ATOMS AND MOLECULES OF GASES.
Ya.M.Fogel', V.A.Ankudinov, D.V.Pilipenko and N.V.Topolya.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 579-92 (1958). In Russian.

The effective cross-sections for capture and loss of electrons in single collisions between 5-40 keV hydrogen atoms with He, Ne, A, Kr and Xe atoms and H_2, N_2 and O_2 molecules are measured by a mass-spectrometric method. A.

537.564

7138. THE COMPOSITION OF AN EQUILIBRIUM BEAM FORMED DURING THE PASSAGE OF SINGLY-CHARGED OXYGEN IONS ACROSS A GASEOUS TARGET.
Ya.M.Fogel', L.I.Krupnik, A.G.Koval' and R.P.Slabospitskiĭ.
Zh. tekh. Fiz., Vol. 27, No.5, 988-96 (1957). In Russian.

For previous work see Abstr. 441 (1956). Singly-charged positive oxygen ions with beam energies from 12.3 to 46.2 keV were fired through flowing gaseous targets of Ne, A, H_2, N_2 and O_2 respectively. The equilibrium charged state of the beam was determined and curves are given for variation of I^-/I^+ with beam energy for the various gases studied. The variation of I^-/I^+ with gas pressure gives a maximum at pressures of the order 3-4 mm Hg.
C.R.S.Manders

537.571

7139. THE IONIZATION OF LIQUID ARGON BY α-PARTICLES.
F.D.Stacey.
Austral. J. Phys., Vol. 11, No. 2, 158-67 (June, 1958).

Calculations suggest that in liquid argon the column of ionization produced by an α-particle consists of positive charge $0.6\text{-}1.5 \times 10^{-5}$ cm in diameter concentric with a larger cloud of electrons extending to a diameter of 40×10^{-5} cm. This leads to a new description of charge separation in an applied electric field, in which the positive and negative charges are drawn apart slightly (polarized) and the more energetic electrons escape from the edge of the column. The remaining electron cloud reaches a state of dynamic equilibrium with the excess positive charge in a time short compared with that required for ionic recombination, which does not have a significant effect on the ionization current. The distribution of electron energies in the column of ionization is calculated from the results of recent ionization current measurements, and indicates that a 5.3 MeV α-particle expends 0.5 MeV as kinetic energy of the liberated electrons. A.

537.58

7140. FACTOR $(1 - \bar{R})$ IN THE EQUATION OF THERMIONIC EMISSION. D.G.Bulyginskiĭ.
Zh. tekh. Fiz., Vol. 28, No. 4, 732-9 (1958). In Russian.

A method is described by which the factor $(1 - \bar{R})$ in the general equation of thermionic emission,

$$j_\perp = (1 - \bar{R}) AT^2 \exp(-e\phi/kT),$$

can be determined without calculating the area of the cathode aperture. The absolute value of $(1 - \bar{R})$ determined for W foil was ~80-85% and agreed well with that predicted from theoretical considerations. Within a temperature interval of 200-250°C, $(1 - \bar{R})$ did not depend on the cathode temperature (≅1500°C).
M.H.Sloboda

537.583 : 536.21

7141. THE THERMAL CONDUCTIVITY OF AN OXIDE CATHODE.
Ya.P.Zinherman.
Ukrayin fiz. Zh., Vol. 1, No. 3, 308-11 (1956). In Ukrainian, with summary ($\frac{1}{2}$ p.) in Russian.

The temperature of the metal core is measured by a W—Ni thermocouple and temperatures taken at two other points, at known distances from the first thermocouple, by two further junctions of Pt-Pt.Rh. Over a temperature range from −200 to +700°C the thermal conductivity is $\sim 10^{-6}$ cal cm^{-1} sec^{-1} $grad^{-1}$. With core temperature about 500°C the temperature distribution in the system is markedly non-linear due perhaps to the formation of an intermediate layer between oxide layer and core. C.R.S.Manders

537.583

7142. EFFECTS OF THE EVAPORATION PRODUCTS FROM THERMIONIC-CATHODE MATERIALS, ESPECIALLY BARIUM, ON THE TRANSFORMATIONS OCCURRING IN METALLIC OXIDES DURING THEIR ELECTRONIC BOMBARDMENT. H.S.Mykhaĭlov.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 95-6 (1957). In Ukrainian.

537.583

7143. ON CERTAIN PROCESSES OCCURRING IN AN OXIDE THERMO-CATHODE DURING PROLONGED OPERATION.
Ya.P.Zinherman.
Ukrayin. fiz. Zh., Vol. 2, No. 2, 183-90 (1957). In Ukrainian.

Using various cores with a BaO layer and with heating times of 3000 hr, measurements were made of (i) saturation current, (ii) outer and inner half-layer resistance of the oxide coating, (iii) thermo-e.m.f. of the inner half-layer, (iv) vacuum factor of the experimental tube. For Ni—Cr cores these parameters remain practically unchanged over the period with temperatures of 750°C and $i_a = 25$ mA/cm^2. For pure electrolytic Ni the parameters varied markedly. "Normal" working is obtained with an oxide coating on electrolytic Ni only for a high anode current density (~ 0.5 A/cm^2).
C.R.S.Manders

COSMIC RAYS

537.591.1

7144. THE COSMIC RAY PHOTON AND π^0-MESON ENERGY SPECTRA AT 29-30 km ABOVE SEA-LEVEL. G.Svensson.
Ark. Fys., Vol. 13, Paper 28, 347-68 (1958).

The photon spectrum at 29-30 km above sea-level and 64°-65° geomagnetic latitude was determined by means of the nuclear emulsion technique, the multiple scattering of the electron-pairs, produced when the photons materialize in the emulsion,being measured. Distortion, noise, energy loss of the electrons, outscattering and materialization probability were taken into account. The relation between the recorded photon spectrum and the π^0-meson spectrum was studied. The exponent obtained for the differential energy spectrum of the π^0-mesons is 1.5 ± 0.2 in the total energy interval from 0.25 GeV to 3 GeV and 2.8 ± 0.4 for energies greater than 3 GeV. The last exponent may suffer from systematic errors due to distortion, spurious scattering and scanning efficiency, which are difficult to estimate. A.

537.591.1

7145. THE INTENSITY AND ANGULAR DISTRIBUTION OF MU-MESONS 1100 FEET UNDERGROUND.
C.A.Randall and W.E.Hazen.
Nuovo Cimento, Vol. 8, No. 6, 878-81 (June 16, 1958).

The results of the determination of the intensity and angular distribution of the μ-mesons at a depth of 8.5×10^4 g/cm^2 underground are $I = I_0 \cos^n\theta$ with $I_0 = (2.10 \pm 0.5) \times 10^{-6}$ sec^{-1} cm^{-2} sr^{-1} and $n = 2.3 \pm 0.3$. The significance of the results in determining the parentage of the μ-mesons is discussed. A.

537.591.1

7146. ABUNDANCE OF LIGHT NUCLEI IN THE PRIMARY COSMIC RADIATION. M.V.K.Appa Rao, S.Biswas R.R.Daniel, K.A.Neelakantan and B.Peters.
Phys. Rev., Vol. 110, No. 3, 751-65 (May 1, 1958).

The composition of the primary cosmic radiation is modified as a result of nuclear collisions which particles suffer in transit through the interstellar medium. The most sensitive indicator for the frequency of such collisions is the number of nuclear fragments corresponding to lithium, beryllium, and boron, which are found in the incident radiation close to the top of the atmosphere. It is, however, difficult to determine what fraction of these particles originated in outer space and what fraction is due to additional nuclear collisions in the uppermost layers of the atmosphere above the point of observation. In order to determine the relative importance of these two components, the percentage has been measured of light elements in the primary cosmic radiation as a function of the amount of air traversed by the particles. These measurements are based on an analysis of 651 particle tracks recorded at geomagnetic latitude

$\lambda = 41^0$. The relative intensities obtained under air masses varying from 8.5 to 30 g/cm^2 are in good agreement with individual values for vertically incident particles obtained by other workers. The data were obtained at a rather great altitude (6.6 g/cm^2 of residual pressure), so that they permit an extrapolation to the top of the atmosphere which is largely independent of assumptions regarding the collision cross-sections and fragmentation probabilities of complex nuclei. The following primary flux values, in particles per m^2 sec sterad were obtained:

Li, Be, B (L nuclei)		0.55 ± 0.60
C	2.65 ± 0.40	
N	1.90 ± 0.35	
O+F	3.00 ± 0.45	
C, N, O, F (M nuclei)		7.55 ± 0.65
Z ≥ 10 (H nuclei)		2.20 ± 0.35

Thus Li, Be, and B nuclei represent but a small fraction of the flux of heavy primary particles. In order to account for this composition, the amount of interstellar gas traversed by the particles since their initial acceleration cannot have exceeded 1 g/cm^2 of hydrogen, as will be shown in detail in a separate paper. The smallness of this value imposes very stringent conditions on acceptable theories for the acceleration and subsequent diffusion of cosmic-ray particles. A.

537.591.1

7147. EXPERIMENTAL EVIDENCE OF THE DIRECTIONAL COMPONENTS OF COSMIC RAYS. A.E.Sandström.
Tellus, Vol. 8, No. 1, 18-25 (Feb., 1956).

It is possible to resolve the diurnal variation into two components. The first of these has its maximum at 18 h and corresponds to the particle wind predicted in the theory by Alfvén (Abstr. 2366/1955). The amplitude ought to be constant both as a function of geomagnetic activity and as a function of time. The second component has its maximum at 12 h. It represents the sum of the various kinds of radial particle flow, and it ought to display variations indirectly related to geomagnetic activity. A search for experimental evidence of these components is made possible through the determination of the incidental directions of the primary particles by Brunberg and Brunberg and Dattner (Abstr. 5670/1954). An analysis of C.R. measurements from Stockholm, Nagoya, and Huancayo seems to confirm the two components and their expected properties. A very doubtful amplitude change of the 18 h-component during major magnetic storms is not at variance with theory. The Stockholm measurements were treated by Sandström (Abstr. 9749/1955) as to geomagnetic effects, those from Nagoya and Huancayo by Sekido and Kodama (Abstr. 7542/1954). A seasonal phase shift reported by the latter for geomagnetically quiet days is compared to measurements in Stockholm. If it exists at all the reported phase shift is evidently due to local effects. Other secular or seasonal phase shifts have not been treated in the present study, as the data did not provide any example of these effects. Several points are open to discussion because of the data's being collected with instruments of widely different properties. Directional counter telescopes offer the most valuable results, if they are designed for a comparatively small aperture and measure in at least two directions. A.

537.591.1 : 539.1.07

MEASUREMENTS OF HIGH-ENERGY COSMIC-RAY PARTICLES. See Abstr. 6095

537.591.15

7148. ANALYSIS OF COSMIC RAY BURSTS IN A THICKLY SHIELDED IONIZATION CHAMBER.
S.D.Chatterjee and G.Ramaswamy.
Bull. Nat. Inst. Sci. India, No. 9, 44-57 (issued Oct. 18, 1957).

Cosmic-ray bursts recorded in a shielded integrating ionization chamber for 134 complete days were analysed in the light of their (i) size-frequency distribution, (ii) interval distribution and (iii) diurnal variation. It was shown that the smaller bursts are due to a readily absorbable radiation of a low intensity, while the larger bursts are due to a penetrating radiation of a high intensity. Furthermore, it is shown by statistical methods that the frequency of occurrence of bursts during the day is significantly greater than those during night. A.

537.591.15

7149. SOME REMARKS ON THE SUDDEN COSMIC RAY INCREASE ON FEBRUARY 23, 1956.
E.Å.Brunberg and D.Eckhartt.
Tellus, Vol. 8, No. 4, 508-12 (Nov., 1956).

The north and south pointing G.M.-telescopes at Stockholm measured different cosmic-ray increases during the solar flare. It is shown that this difference is due to particles of momenta greater than 10 GeV/c, which could not have travelled along straight-line paths from the sun. A.

537.591.15

7150. CLOUD-CHAMBER INVESTIGATION OF THE NUCLEAR-ACTIVE COMPONENT OF ATMOSPHERIC SHOWERS.
I.A.Ivanovskaya, L.I.Sarycheva and P.S.Chikin.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 45-52 (1958). In Russian.

Nuclear processes induced by particles of extensive air showers were studied using a cloud chamber containing 7 lead plates. The spatial distribution of nuclear-active particles in extensive showers as well as the nature and energy spectrum of the particles were determined. A.

537.591.15

7151. WILSON CLOUD-CHAMBER INVESTIGATION OF THE ELECTRON–PHOTON COMPONENT OF EXTENSIVE ATMOSPHERIC SHOWERS NEAR THE AXIS AT AN ALTITUDE OF 3860 m [ABOVE SEA LEVEL].
T.V.Danilova, O.I.Dovzhenko, S.I.Nikol'skiĭ and I.V.Rakobol'skaya.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 541-7 (1958). In Russian.

Energy spectra of the electron–photon component of extensive air showers were investigated at an altitude of 3860 m and at various distances from the axis. Showers with $\overline{N} = 1.5 \times 10^5$ were recorded. The fraction of high-energy electrons and photons recorded experimentally was appreciably smaller than that computed from cascade theory, especially at small distances from the axis. At larger distances from the axis better agreement between theory and experiment was obtained. The spatial distribution of the energy carried by the electron–photon shower component can be approximated by the law r^{-n}, where $n = 1.5 \pm 0.3$ for distances from the shower axis of 1 to 9 m and for showers with $\overline{N} = 2 \times 10^5$. A.

537.591.15

7152. INVESTIGATION OF A SHOWER PRODUCED BY A SINGLY CHARGED PARTICLE OF HIGH ENERGY.
É.G.Boos, A.Kh.Vinitskiĭ, Zh.S.Takibaev and I.Ya.Chasnikov.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 622-31 (1958). In Russian.

A 2 + 16p cosmic-ray shower produced by a singly charged particle of $(5^{+10}_{-3}) \times 10^{13}$ eV energy is analysed. The energy spectrum of the secondary particles differs from that predicted by Landau's theory but is consistent with Heisenberg's theory. The inelasticity coefficient is significantly smaller than unity. The fraction of energy expended in meson formation is of the order of 10-15%. The ratio of neutral π^0-mesons to charged shower particles is $R = 0.54 \pm 0.18$, which indicates that a small fraction of the charged shower particles consists of heavy mesons and nucleons. A.

537.591.15

7153. NUCLEAR INTERACTION IN A PHOTOGRAPHIC EMULSION ACCOMPANIED BY A LARGE TRANSFER OF ENERGY TO THE ELECTRON–PHOTON COMPONENT.
G.B.Zhdanov, E.A.Zamchalova, M.I.Tret'yakova and M.N.Shcherbakova.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 843-8 (1958). In Russian.

A cosmic-ray event in which the primary energy was 250^{+250}_{-125} BeV, with 200 BeV carried away by one of the π^0-mesons, is investigated in great detail. The lower limit of the energy going over to the soft component is approximately 30% of the total shower energy. A.

537.591.2

7154. ON THE RANGE SPECTRUM OF μ-MESONS AT SEA-LEVEL AT GEOMAGNETIC LATITUDE 24^{0}N.
S.Fukui, T.Kitamura and Y.Murata.
J. Phys. Soc. Japan, Vol. 12, No. 8, 854-63 (Aug., 1957).

Differential intensities were measured for the residual range equivalent to from 44 to 430 g/cm^2 of the air, using a delayed coincidence method. It was found that the obtained range-spectrum was nearly flat for present ranges and was 20% lower than Rossi's curve, which should be valid at a geomagnetic latitude greater than 45^0. The effect of the lateral displacement as well as the angular deflection of particles in the absorber was taken into account for the scattering correction. Mesons locally produced in the absorber were found to be at most a few per cent of all mesons that stop and decay in the apparatus. This fact suggests that the discrepancy between μ-meson spectra by the absorption method and by the magnetic cloud chamber method can not be accounted for only by the local π-meson production. A.

537.591.2

7155. COSMIC RAYS IN THE TERRESTRIAL MAGNETIC DIPOLE FIELD. E.Å.Brunberg.
Tellus, Vol. 8, No. 2, 215-33 (May, 1956).

The results of scale model experiments with electron orbits in a magnetic dipole field are given in the form of diagrams on big globes. By using these globes it is possible to find the asymptotic directions of cosmic ray particle orbits as a function of momentum and direction of incidence at a cosmic-ray recording station. Globes, representing 16 stations, are depicted. A.

537.591.2

7156. FOCUSING OF PARAXIAL RAYS IN A MAGNETIC DIPOLE FIELD. E.Åström.
Tellus, Vol. 8, No. 2, 254-9 (May, 1956).

A magnetic field of axial symmetry has a focusing effect for paraxial orbits. The field of the earth is of this type and it is shown that, if the cosmic rays consist of protons, a bundle of orbits parallel at infinite distance is focused on the surface of the earth if the energy is about 10 GeV. The co-latitude of the bundle at infinite distance is about 2.2 times the co-latitude of the focal point. The asymptote to the orbits is about 22° further to the east than the focal point. There is also an infinite series of lower energies exhibiting focusing properties. The calculations refer to paraxial orbits, but a comparison with terrella measurements shows that the focal energy and the above relation between the co-latitudes are appropriate down to about 50° latitude. A.

537.591.5

7157. ON THE INTERPRETATION OF SUDDEN DECREASES IN COSMIC RAYS FROM THE SUN. E.Tandberg-Hanssen.
Astrophys. Norveg., Vol. 5, No. 9, 241-58 (Sept., 1956).

The changes in cosmic-ray intensity (CRI) — especially short-lived intensity decreases — and their relation to solar activity were investigated. The following results were obtained. (1) The active regions responsible for short-lived decreases in cosmic-ray intensity are not necessarily associated with sunspots, or flares or unipolar magnetic (UM) regions. They may have other characteristics than the active regions responsible for CRI increases. (2) There is no one-to-one correlation between CRI decreases and magnetic storms. Recurrent storms with gradual commencement often occur simultaneously with CRI decreases, and also series of storms with sudden commencement coincide with CRI decreases. (3) The investigation supports the view that cosmic-ray emission is a normal quiet-sun quality. (4) CRI decreases are thought to be caused by a shielding process taking place in ejected clouds of ionized gas pervaded by magnetic fields. A.

537.591.5

7158. A SURVEY OF THE COSMIC-RAY NUCLEONIC COMPONENT ALONG 145° EAST LONGITUDE, USING AN AIR-BORNE MONITOR. J.R.Storey, A.G.Fenton and K.G.McCracken.
Nature (London), Vol. 181, 1155-6 (April 19, 1958).

The survey, carried out to provide information to assist in finding a system of coordinates for the description of the earth's effective magnetic field for cosmic rays was made between 38° S and 34° N, and from 38° S to 52° S. The minimum point of the latitude–intensity curve lies at 7.1 ± 0.5° N geographic latitude. This result gives support to the suggestion that the cosmic-ray equator follows the magnetic dip equator rather than the rotated dipole equator. It is suggested that at intermediate latitudes conventional geomagnetic coordinates are to be preferred to rotated dipole coordinates, since they preserve symmetry between the observed positions of the "knee" of latitude intensity curves in the two hemispheres. P.Rothwell

MAGNETISM

538.082.102

7159. CONSTRUCTION OF A TRANSLATION BALANCE FOR THE MEASUREMENT OF MAGNETIC SUSCEPTIBILITIES AT LOW TEMPERATURES. J.Cohen.
C.R. Acad. Sci. (Paris), Vol. 246, No. 25, 3425-7 (June 23, 1958). In French.

Describes a compact balance suitable for use at low temperatures and in a controlled atmosphere, and with a sensitivity for susceptibility measurements of 5×10^{-11} e.m.u. A.E.De Barr

538.11

7160. OSCILLATIONS OF THE MAGNETIC QUANTITIES OF A DEGENERATE ELECTRON GAS IN A PARABOLIC POTENTIAL HOLE. A.M.Kosevych.
Ukrayin. fiz. Zh., Vol. 1, No. 4, 339-46 (1956). In Ukrainian, with summary (2 pp.) in Russian.

See Abstr. 5788 (1954). Starting with an examination of the oscillations of thermodynamic quantities an account is given of the magnetic properties of the model at low temperatures, and applied to the case of a small metal specimen. The conclusions reached are well supported experimentally. C.R.S.Manders

538.114 : 538.652

7161. EFFECTIVE MAGNETIC ANISOTROPY AND MAGNETOSTRICTION OF MONOCRYSTALS. P.K.Baltzer.
Phys. Rev., Vol. 108, No. 3, 580-7 (Nov. 1, 1957).

The effective magnetic anisotropy energies associated with the domain theory are derived to second order for cubic crystals. These effective anisotropy energies are expressed in terms of the intrinsic anisotropy for an undeformed crystal, the magnetostriction, and the elastic moduli. Also, in the process of deriving the effective anisotropy energies to second order, the expression for the magnetostriction of a cubic crystal is expanded to sixth order in the direction cosines for the magnetization. The interrelation between the effective anisotropy in domains and domain walls is studied and its influence upon the domain configuration suggested. A.

538.114

7162. CORRELATIONS SUGGESTING THE D-SHELL CONFIGURATION AND A MAGNETIC EXCHANGE MECHANISM IN IRON GROUP METALS. E.O.Wollan.
Phys. Rev., Vol. 110, No. 5, 1205-6 (June 1, 1958).

It is suggested that the ground state d-shell configurations of the iron group metals are those appropriate to the 3+ ion, the remaining three electrons per ion being itinerant. Arguments similar to those used by Goodenough in discussing magnetic exchange in the perovskite compounds (Abstr. 2564/1956) are then used to account for some of the magnetic properties of iron and chromium. D.M.Edwards

538.114

7163. CONTRIBUTION TO THE THEORY OF ANTIFERROMAGNETISM AT LOW TEMPERATURES.
M.I.Kaganov and V.M.Tsukernik.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 106-9 (1958). In Russian.

The energy spectrum of a uniaxial antiferromagnetic substance was obtained without invoking nominal magnetization of the spin sublattices in the ground state. A.

538.122.08

7164. DYNAMIC AND STATIC MEASUREMENTS OF STRONGLY INHOMOGENEOUS MAGNETIC FIELDS. B.De Raad.
University of Delft Dissertation (1958) 143 pp.

Describes techniques and instruments for measuring the magnitude and distribution of the flux density in strongly inhomogeneous and time dependent magnetic fields of electromagnets. The methods used are based on the measurement of electromagnetic induction in a pick-up coil and on the use of an electronic integrator. E.P.Wohlfarth

538.22

7165. TEMPERATURE DEPENDENCE OF THE MAGNETIC SUSCEPTIBILITY OF α-SILVER-ZINC ALLOYS.
L.Meyer and D.Weiner.
Phys. Rev., Vol. 108, No. 6, 1426-7 (Dec. 15, 1957).

The magnetic susceptibility of α-silver-zinc alloys was measured from 5-35% Zn between room temperature and helium temperatures. All samples became slightly more diamagnetic with decreasing temperature, and any temperature-dependent paramagnetic contribution to the susceptibility due to bound electron states must be less than 0.1% of the room-temperature value of the susceptibility. A.

538.22

7166. MAGNETIC SUSCEPTIBILITY OF ALKALI ELEMENTS. I. SODIUM AND POTASSIUM. K.Venkateswarlu and S.Sriraman.
Z. Naturforsch., Vol. 13a, No. 6, 451-5 (June, 1958).

A vacuum Curie balance was specially designed for the study of magnetic susceptibilities at higher temperatures. With this apparatus the magnetic study of sodium and potassium was made at different temperatures ranging from 32° to 250° C. Special attention was paid to the preparation of the specimen. Corrections for all possible errors were made. The results point out that the suceptibilities of

he metals increase with temperature both below and above their nelting points. The temperature coefficients of the susceptibility of alence electrons of the two metals are in general agreement with toner's theory. A.

538.22

7167. MAGNETIC SUSCEPTIBILITY OF ALKALI ELEMENTS. I. LIQUID ALLOYS OF SODIUM AND POTASSIUM.
K.Venkateswarlu and S.Sriraman.
Z. Naturforsch., Vol. 13a, No. 6, 455-8 (June, 1958).

Alloys of sodium and potassium were prepared in vacuum in a pecially blown pyrex glass apparatus. Several bulbs containing hese alloys of different compositions were studied at temperatures anging from 30° to 250°C. The compositions of these alloys were etermined by gravimetric method. The results show that for the lloys of all compositions the additivity law is obeyed both at room emperature and at higher temperatures. No evidence for the ormation of the compound Na_2K could be detected from the magnetic tudy. A.

538.22 : 539.2

7168. ON THE THEORY OF MAGNETIC SUSCEPTIBILITY OF METALS. V.L.Bonch-Bruevich and M.E.Gertsenshtein.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 261 (1958). In Russian.

538.22 : 536.48

7169. THE MAGNETIC PROPERTIES OF RARE EARTH METALS AT VERY LOW TEMPERATURES. H.Leipfinger.
Z. Phys., Vol. 150, No. 4, 415-35 (1958). In German.

Reports results of susceptibility measurements of metallic Ce, Pr, Nd, Sm, Tb, Dy, Ho, Tm and Yb as well as some of their salts down to 1.5°K. In some cases differences with earlier results are bserved and these are ascribed to impurities or the physical state f the specimens; powdered Dy does not exhibit ferromagnetism. E.P.Wohlfarth

538.221

7170. DIPOLAR ENERGY. APPLICATION TO THE MAGNETOSTATIC ENERGY OF α-Fe_2O_3. F.Bertaut.
C.R. Acad. Sci. (Paris), Vol. 246, No. 24, 3335-7 (June 16, 1958). n French.

The dipole interaction cannot account for the weak ferromagnetsm nor the magnetic anisotropy of haematite. E.P.Wohlfarth

538.221

7171. TEMPERATURE INDEPENDENT SPONTANEOUS MAGNETIZATION OF COBALT PRECIPITATES IN A COPPER MATRIX. A.Knappwost and A.Illenberger.
Naturwissenschaften, Vol. 45, No. 10, 238 (1958). In German.

Magnetic experiments on small (8-20 A) Co precipitates show hat the spontaneous magnetization is independent of temperature up o room temperature, which is unexpected in view of Klein and Smith's results. E.P.Wohlfarth

538.221

7172. A SEMI-EMPIRICAL EQUATION FOR THE INITIAL SUSCEPTIBILITY OF HOMOGENEOUS FERROMAGNETIC ALLOYS.
C.W.Lee and R.C.Jackson.
Proc. Phys. Soc., Vol. 72, Pt 1, 130-4 (July, 1958).

The equation relates the initial susceptibility to the magnetorystalline anisotropy and magnetostriction coefficients, and gives easonable agreement with experimental values for disordered Fe—Ni alloys. E.P.Wohlfarth

538.221

7173. ON THE TEMPERATURE DEPENDENCE OF THE COERCIVE FORCE IN THIN SPECIMENS OF NICKEL AND NICKEL-IRON ALLOYS. E.Kondorskiĭ and M.Rosenberg.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 4, 753-6 (1958). In Russian.

The temperature dependence of the coercive force H_c of both work-hardened and annealed Fe—Ni alloys containing 85, 78 and 50% Ni was investigated in the temperature range −196 to +300°C on specimens whose thickness d varied from 0.35 to 0.005 mm. The effect of d on H_c in the work-hardened specimens was masked by a considerable increase of H_c due to internal stresses but a definite relationship between H_c and d of the annealed alloys was established, the value of H_c rising sharply below a certain critical value of d. The increase of H_c observed at d = 0.005 mm in materials characterized by comparatively low values of the anisotropy constant is attributed to the effect of gaseous impurities picked up by the metal during its heat treatment, and it is postulated that higher permeability and lower H_c can be attained in materials of this type by improved heat-treatment techniques. M.H.Sloboda

538.221 : 539.231 : 537.311.31

7174. MAGNETIC, ELECTRICAL AND ELECTRON-OPTICAL INVESTIGATIONS ON THE THERMAL CHANGE IN SPUTTERED NICKEL FILMS. L.Reimer.
Z. Phys., Vol. 149, No. 4, 425-31 (1957). In German.

Magnetic measurements show that sputtered nickel films, which have a hexagonal structure when laid down that changes to cubic when heated to about 400°C, become ferromagnetic at the change point. The course of the change is investigated by measurements of electrical resistance at various temperatures, and the structure of the films is investigated by electron diffraction and electron microscopy. J.Thewlis

538.221 : 539.232

7175. MAGNETIC PROPERTIES AND ELECTRON MICROSCOPICAL STRUCTURE OF ELECTRODEPOSITED THIN FILMS OF NICKEL—IRON ALLOYS. L.Reimer.
Z. Phys., Vol. 150, No. 1, 99-105 (1958). In German.

The electron microscope observations reveal a very fine grained structure in very thin apparently single-domain films. The coercivities of the more iron-rich (77%, 60% Ni) films, being proportional to the saturation magnetization, are thought to be governed by a very weak shape anisotropy. For films above 500 A the coercivities are interpreted in terms of strains. E.P.Wohlfarth

538.221

7176. REPRODUCIBLE THERMOMAGNETIC REMANENCE IN NICKEL OXIDE AND THE ALLOYS Pd_3Mn_2 AND CrSb.
N.Perakis, J.Wucher, G.Parravano and R.Wendling.
C.R. Acad. Sci. (Paris), Vol. 246, No. 21, 3037-40 (May 28, 1958). In French.

The effect has been observed in the antiferromagnetic substances by cooling them in a magnetic field. It depends on the magnitude of the field and on the temperature, and vanishes by heating to the Néel point. E.P.Wohlfarth

538.221

7177. FERROMAGNETIC RESONANCE IN POLYCRYSTALLINE FERRITES. J.Snieder.
University of Delft Dissertation, 59 pp. (1958).

An experimental and theoretical study is made of the propagation of TE_{11}-waves of 3.2. cm wavelength in a circular waveguide containing a cylinder of Ferroxcube IV magnetized along the axis. The Faraday rotation and the ellipticity was determined as a function of field strength and temperature between −30°C and 100°C. The theory of ferromagnetic resonance was used to obtain values of the permeability tensor in terms of the experimental parameters. The influence of porosity on various factors is discussed. D.J.Oliver

538.221 : 621.318.12

7178. LOW-FREQUENCY ROTATIONAL HYSTERESIS LOSSES IN FERRITES. H.Seiwatz.
J. appl. Phys., Vol. 29, No. 6, 994-5 (June, 1958).

Rotational hysteresis losses in various ferrites were measured in the frequency range from 5 to 55 c/s using magnetic field strengths up to 11 000 Oe. For sufficiently strong magnetic fields, the rotational hysteresis losses are found to become independent of magnetic field strength. In some ferrites the rotational hysteresis loss per cycle is found to be essentially independent of frequency. A.E. De Barr

538.221 : 621.318.12

7179. MAGNETIC MATERIALS FOR USE AT HIGH MICROWAVE FREQUENCIES (50-90 kMc/sec).
F.K.du Pré, D.J.De Bitetto and F.G.Brockman.
J. appl. Phys., Vol. 29, No. 7, 1127-8 (July, 1958).

Experiments show that by suitable partial substitution of Fe_2O_3 by Al_2O_3 in oriented ferroxdure, $BaO.6Fe_2O_3$, the no-field resonance frequency can be made to occur at any frequency in the 50-90 kMc/s range. A similar effect is found in $SrO.6Fe_2O_3$. R.C.Glass

538.221

7180. ANOMALOUS MAGNETIC PROPERTIES OF Ba FERRITE AS A FUNCTION OF SINTERING TEMPERATURE. G.Heimke.
Naturwissenschaften, Vol. 45, No. 11, 260-1 (1958). In German.

The density and remanence decrease and the coercivity increases on raising the sintering temperature of $BaO.6Fe_2O_3$ containing 1% SiO_2 (in the form $CaO.SiO_2$) from 1150° to 1180°C, due to a phase change of the silicate at 1150°C. E.P.Wohlfarth

538.221

7181. RELATION BETWEEN DISACCOMODATION AND MAGNETIC PROPERTIES OF MANGANESE-FERROUS FERRITE. U.Enz.

Physica, Vol. 24, No. 7, 609-24 (July, 1958).

Initial permeability, crystalline anisotropy and magnetostriction were measured on a single crystal of manganese–ferrous ferrite. The initial permeability shows a high disaccomodation, i.e. a decrease with time. This decrease can be as high as 95% of the value immediately after demagnetization. Disaccomodation is a time-dependent blocking of domain walls, the cause of which is supposed to be a transition of electrons between different ions. The blocked walls cause constricted minor hysteresis loops which indeed have been found. Manganese–ferrous ferrites have in general an extra peak of the permeability as a function of temperature not understood up till now. It is shown that this is an effect of disaccomodation. A.

538.221

7182. ON MAGNETIC SUPERVISCOSITY OF FERRITES. R.V.Telesnin and E.V.Karchagina.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 23-8 (1958). In Russian.

Behaviour of the magnetic superviscosity curves of the series of NiZn ferrites fused at temperatures from 1200° to 1400°C was studied at 78°K. A second maximum of the viscous e.m.f. was detected at field strengths smaller than the coercive force and corresponding to the rapidly rising part of the differential magnetic susceptibility curve. The decrease of the viscous e.m.f. curves after the second maximum is of hyperbolic type. With increase of the field the second maximum merges with the main maximum and the viscous e.m.f. curve begins to resemble an exponential curve. The observed phenomena can be explained within the framework of Néel's theory. A.

538.221 : 621.318.12

7183. THE TEMPERATURE DEPENDENCE OF THE MAGNETIC PROPERTIES OF BARIUM FERRITE. E.Schwabe.
Z. angew. Phys., Vol. 9, No. 4, 183-7 (April, 1957). In German.

The variation of the magnetic properties of barium ferrite magnets with temperature is reversible on the upper, reversible portion of the demagnetization curve. In this region it is determined by the variation with temperature of the saturation magnetization. The temperature coefficient of the apparent remanence also corresponds in this region to a value of about −0.2% per deg C for the temperature coefficient of the saturation magnetization. As the irreversible portion of the hysteresis loop is approached, a large variation of coercive force with temperature is observed (0.5% per deg C) on cooling, whilst on warming up again there is an irreversible decrease in the apparent remanence and, therefore, in the air gap flux of a magnet system. The application of the results to magnet design is discussed. A.E.De Barr

538.221 : 537.226.2

MAGNETIC SPECTRA OF γ-Fe_2O_3. See Abstr. 6940

538.222

7184. MAGNETIC PROPERTIES OF CERTAIN RARE EARTH DOUBLE NITRATES. B.R.Judd and E.Wong.
J. chem. Phys., Vol. 28, No. 6, 1097-100 (June, 1958).

Paramagnetic resonance experiments were performed with crystals of diluted erbium magnesium nitrate and diluted holmium magnesium nitrate. Resonance was observed in the first case but not in the second. These experimental results and in addition the Zeeman effects in neodymium magnesium nitrate are interpreted in terms of a crystalline electric field of predominantly icosahedral symmetry. A.

538.222 : 539.2

7185. MAGNETIC SUSCEPTIBILITIES AT LOW TEMPERATURES OF "COMPLEX" INORGANIC SALTS OF THE FIRST TRANSITION GROUP. J.J.Fritz, R.V.G.Rao and S.Seki.
J. phys. Chem., Vol. 62, No. 6, 703-6 (June, 1958).

Magnetic susceptibilities were measured between 1.5 and 20°K for six compounds of the "iron" (first transition) group, using an a.c. method especially designed for rapid and accurate measurements. The apparatus is described in detail. With one exception, the various sorts of coordination present in the compounds studied did not alter the number of unpaired electrons in the ion, but did lead to large and specific interactions between the ions. A.

538.222 : 538.224

7186. INVESTIGATION OF THE MAGNETIC SEPARABILITY OF OXYGEN AND NITROGEN. H.J.Hübner and H.Kläukens.
Z. Phys., Vol. 151, No. 1, 16-19 (1958). In German.

The paramagnetism of oxygen being approximately 300 times as strong as the diamagnetism of nitrogen, separation should occur in a magnetic field. The diffusion equation for oxygen in a magnetic field between coaxial, cylindrical pole-pieces is solved both for a numerical special case and generally. It is found that fields of the order of 10^7 Oe are required for efficient separation, and that a concentration-minimum develops between the pole-pieces before the final monotonic distribution of concentration is attained. B.Meltzer

538.222.07

7187. EPR SPECTROMETER OF VERY HIGH SENSITIVITY. H.Misra.
Rev. sci. Instrum., Vol. 29, No. 7, 590-4 (July, 1958).

A recording electron paramagnetic resonance absorption spectrometer of very high sensitivity, operating at a wavelength of 3 cm, is described. It is of the reflection-cavity-in-magic-T-bridge type, using a superheterodyne receiver. Its special features are: (1) a two-cavity klystron oscillator with superior frequency stability and more available power; (2) a synchrodyne system to derive local oscillator power, thus avoiding the difficulty of tracking two independent oscillators; (3) a balanced magic-T mixer which considerably reduces the noise output; (4) a double-input low-noise intermediate frequency amplifier at 30 Mc/s; and (5) a tunable high-Q sample-carrying cavity with an almost identical cavity to balance it in the magic-T bridge. Arrangements for an oscilloscopic display of the absorption v. magnetic field and a continuous recording of the derivative of absorption v. magnetic field have been incorporated. Sensitivity of the microwave bridge system and of the spectrometer have been tested. About 1.1×10^{-11} mole of diphenyl picryl hydrazyl dissolved in purified benzene, which corresponded to approximately 1.06×10^{-14} mole of crystalline sample, has been detected by the spectrometer. A.

538.23

7188. CONCERNING THE EFFECTS OF COUPLING BETWEEN FERROMAGNETIC PARTICLES EXHIBITING HYSTERESIS. L.Néel.
C.R. Acad. Sci. (Paris), Vol. 246, No. 16, 2313-19 (April 21, 1958). In French.

Considers an assembly of ferromagnetic particles interacting in pairs. According to the nature of the hysteresis cycles described, the magnetization produced on applying a field H a second time is not in general equal to that produced the first time, as in the usual models. D.J.Oliver

538.23

7189. COUPLING BETWEEN ELEMENTARY FERROMAGNETIC DOMAINS: THE "SEESAW" EFFECT. L.Néel.
C.R. Acad. Sci. (Paris), Vol. 246, No. 21, 2963-8 (May 28, 1958). In French.

Extends previous work (see preceding abstract). The initial hysteresis cycle for an assembly of interacting domains is not a closed curve. The gap is a rapidly decreasing function of the number of cycles of applied field. D.J.Oliver

538.23

7190. CHARACTERISTIC FEATURES OF THE NÉEL THEORY OF THE MAGNETIC AFTER-EFFECTS OF FOREIGN ATOMS. F.Schreiber.
Z. angew. Phys., Vol. 9, No. 4, 203-12 (April, 1957). In German.

A simplified exposition of Néel's theory of magnetic viscosity due to diffusion of interstitial foreign atoms (Abstr. 7407/1952) is given for the restricted case of a single time constant (single Bloch wall). Electric circuit analogues are set up to illustrate the Richter magnetic after-effect and the dependence of the initial permeability on frequency. A.J.Manuel

538.24 : 539.89

7191. THE INFLUENCE OF HYDROSTATIC PRESSURE ON THE MAGNETIZATION OF Au_2Mn. K.H.v.Klitzing and J.Gielessen.
Z. Phys., Vol. 150, No. 4, 409-14 (1958). In German.

The magnetization below saturation increases markedly (by a factor $2\frac{1}{2}$ at 10^4 oersted and 4.5×10^3 atm) while the threshold field decreases. The results are discussed in terms of the pressure dependence of the molecular field and the crystalline anisotropy. E.P.Wohlfarth

538.244.07 : 621.317.41

7192. A PERMEAMETER CONTROLLER FOR MAGNETIC MEASUREMENTS. M.J.Swan.
J. sci. Instrum., Vol. 35, No. 9, 344-6 (Sept., 1958).

Determinations of the magnetic properties of materials by the ballistic method often involves complicated switching of the magnetizing currents. A semi-automatic controller was built which carries out the switching operations and ensures the material is maintained in a cyclic magnetic state. The N.P.L. permeameter is also briefly described. A.

538.244.2 : 621.318.33

193. STABILIZATION AND CONTROL OF AN ELECTROMAGNET BY MEANS OF MAGNETIC PROTON RESONANCE. H.Andresen. Z. angew. Phys., Vol. 9, No. 7, 326-33 (July, 1957). In German.

An arrangement is described for stabilizing the magnetic field of a 3 kW magnet to one part in a million. A proton resonance probe is used in conjunction with an oscillator of stabilized frequency. By varying this frequency the magnetic field in the air gap can be altered. T.Mulvey

538.245 : 548.736.5

7194. THE SUBSTITUTION OF Fe BY Al, Ga AND Cr IN BARIUM HEXAFERRITE $BaO.6Fe_2O_3$.
F.Bertaut, A.Deschamps and R.Pauthenet.
C.R. Acad. Sci. (Paris), Vol. 246, No. 18, 2594-7 (May 5, 1958). In French.

Reports results of measurements of the saturation magnetization, the lattice parameters and X-ray intensities of $BaO.(6-x)\,Fe_2O_3\,.\,xM_2O_3$, and draws conclusions as to the distribution of the M ions among the lattice sites. E.P.Wohlfarth

538.245

7195. ON THE EXISTENCE OF A MOST PROBABLE MAGNETIZATION JUMP. V.F.Ivlev and V.M.Rudyak.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 3, 495-6 (1958). In Russian.

There is still some uncertainty as to the size distribution of jumps in the Barkhausen effect. Most estimates are of the order of 10^{-6} c.g.s.m. The authors have studied the effect in a piece of electrolytic nickel 0.5 mm in diameter and 35 mm long with an apparatus sensitive to 10^{-7} c.g.s.m. Graphs of the size distribution of Barkhausen jumps are given for annealed and unannealed specimens of the nickel, the most probable values being 1.7 and 1.5. c.g.s.m. respectively. A.L.Mackay

538.248

7196. THE MEASUREMENT OF THE REMANENT MAGNETISM OF THIN FILMS. S.Yamaguchi.
Naturwissenschaften, Vol. 45, No. 9, 205 (1958). In German.

Reports results of measurements using electron diffraction methods of the field at the edge of a nickel oxide film of thickness about 500 A. E.P.Wohlfarth

538.26

7197. ON A DEFINITION OF THE PONDEROMOTIVE INTERACTION FORCE BETWEEN A MAGNET AND A FERROMAGNETIC MATERIAL. V.L.Shmarts.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 556-8 (1957). In Russian.

A mathematical formulation of the field inside a ferromagnetic medium placed in the field of a magnet, leading to a calculation of the force on the ferromagnetic. It is shown that the behaviour of permanent magnet materials is different from that of electromagnet materials. J.M.Hough

ELECTROMAGNETISM. ELECTRODYNAMICS

538.3 : 532.5

7198. MAGNETOGRAVITATIONAL INSTABILITY OF AN INFINITE CYLINDER. É.A.Dibaĭ.
Astron. Zh., Vol. 35, No. 2, 253-6 (1958). In Russian.

In a previous paper (Astron Zh., Vol. 32, 954-6, 1957) a study was made of the instability of a compressible fluid cylinder with respect to longitudinal vibrations. This treatment is now generalized by taking into account the electromagnetic, as well as the gravitational, field. It is shown that the gravitaional instability of an infinite gaseous cylinder with respect to longitudinal oscillations is independent of the presence of an electromagnetic field directed along its axis, and the criterion of gravitational instability is the same whether the field is present or not. The theory is used to investigate the stability of five globules formed as a result of the breaking up of a dark filament in Taurus. The densities and masses of these globules are probably sufficient for the formation of stars from them by gravitational condensation. S.Chomet

538.3

7199. ON THE ENERGY—MOMENTUM TENSOR OF THE ELECTROMAGNETIC FIELD IN A MOVING DIELECTRIC. I.Horváth.
Nuovo Cimento, Vol. 7, No. 5, 628-35 (March 1, 1958).

The Giorgi—Sommerfeld system provides a basis for developing relativistic electrodynamics in dielectrics. It is shown that Abraham's form of the energy—momentum tensor of the electromagnetic field corresponds to the Minkowski expression in the vacuum. As the formulation of the theory has to be dimensionally invariant it can be concluded that the Minkowski energy—momentum tensor of the field is the correct one, not only in the vacuum, but also in dielectrics. M.J.Kearsley

538.3 : 530.12

SINGULAR ELECTROMAGNETIC INDUCTION. See Abstr. 6613

538.3 : 532.5

7200. ON REFLECTION AND REFRACTION IN MAGNETOHYDRODYNAMICS. C.Totaro.
R.C. Accad. Naz. Lincei, Vol. 24, No. 3, 310-16 (March, 1958). In Italian.

The linearized equation

$$(c^2/\mu\sigma)\,\partial\nabla^2\vec{B}/\partial t + (B_0^2/\mu\rho)\,\partial^2\vec{B}/\partial z^2 = \partial^2\vec{B}/\partial t^2$$

for the magnetic induction $\vec{B}$ is established for small disturbances in a liquid of finite conductivity σ in the presence of an external field applied parallel to the z-axis. Fluid velocity and electric intensity and induction are expressed in terms of $\vec{B}$, and the results are applied in a discussion of the reflection and refraction of plane waves at a plane surface of separation of two conducting liquids, the interface being perpendicular to the applied field. R.A.Newing

538.3 : 532.5

7201. OBSERVATIONS ON CYLINDRICAL WAVES IN MAGNETOHYDRODYNAMICS. G.Carini.
R.C. Accad. Naz. Lincei, Vol.22, No. 4, 482-8 (April, 1957). In Italian.

The author's modified Alfvén equations for a moving medium in the presence of an applied uniform magnetic field are used to discuss axially symmetric, cylindrically limited waves. The intensity vector is found to be proportional to the induction vector, to a first approximation, for the induced magnetic field but not for the electric field. R.A.Newing

538.3 : 532.5 : 537.565

7202. KINETIC THEORY OF MAGNETOHYDRODYNAMIC WAVES. K.N.Stepanov.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1292-301 (1958). In Russian.

Propagation of magnetohydrodynamic waves in an ionized gas is considered, with reference to the thermal movement of the electrons and ions. A.

538.311 : 537.312.62

THE SUPERCONDUCTING ELLIPTICAL CYLINDER IN A TRANSVERSE MAGNETIC FIELD. See Abstr. 7042

ELECTROMAGNETIC WAVES AND OSCILLATORS

538.561 : 621.375.9

7203. MINIMUM NOISE FIGURE OF A PARAMETRIC AMPLIFIER. H.Heffner and G.Wade.
J. appl. Phys., Vol. 29, No. 8, 1262 (Aug., 1958).

The noise figure is quoted and it is shown that it will approach a minimum value equal to the ratio of the pumping to the idling frequency. D.Walsh

538.561 : 621.375.9

7204. SOLID-STATE MASER AMPLIFIER.
A.L.McWhorter and J.W.Meyer.
Phys. Rev., Vol. 109, No. 2, 312-18 (Jan. 15, 1958).

The operation of a solid-state maser amplifier at 2800 Mc/s is described. A dual-frequency cavity containing paramagnetic potassium chromicyanide in an isomorphous cobalt diluent is used at 1.25° K. The experimental observations of the maser both as an amplifier and as an oscillator are compared with theory. A.

538.561

7205. CONTRIBUTION TO THE THEORY OF THE MOLECULAR GENERATOR AND OF FLUCTUATIONS OF ITS VIBRATIONS. V.S.Troitskiĭ.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 390-3 (1958). In Russian.

The molecular generator is considered as a self-oscillatory system with one degree of freedom described by Basov—Prokhorov

equation for stationary oscillations. The existence of "soft" excitation conditions and an analogue of "hard" conditions with a preceding region of noise generation is demonstrated. The natural spectral width of the generator line due to thermal noise is determined and found equal to 10^{-4} c/s for an ammonia generator at room temperature. A.

538.561 : 538.566.2 : 551.594.221

7206. ON THE CHARACTERISTIC ELECTRIC OSCILLATIONS OF THE CAVITY EARTH–AIR–IONOSPHERE EXCITED BY LIGHTNING FLASHES. W.O.Schumann.
Z. angew. Phys., Vol. 9, No. 8, 373-8 (Aug., 1957). In German.

Continuation of previous work (Abstr. 5204, 7413/1952). Allowance is made for the effect of the earth's magnetic field and it is shown that signals due to this cause will be much weaker by night than during the day. J.M.Hough

538.561 : 537.56

SUPPRESSION OF PLASMA OSCILLATIONS. See Abstr. 5990

538.566

7207. THE SOMMERFELD GROUND-WAVE. B.Kockel.
Ann. Phys (Leipzig), Folge 7, Vol. 1, No. 1-3, 145-56 (1958). In German.

Another presentation, "in the most simple possible form", of a very old problem (Abstr. 1181/1909). P.K.Kabir

538.566 : 621.372.821

7208. ABSORPTION OF CENTIMETRIC ELECTROMAGNETIC WAVES IN ARTIFICIAL ANISOTROPIC MEDIA. R.Pottel.
Z. angew. Phys., Vol. 10, No. 1, 8-16 (Jan., 1958). In German.

Gives the theory of the propagation and reflection properties of a parallel-plate medium of dielectric ferromagnetic plates parallel to the direction of propagation and to the magnetic field vector. Measurements of the properties of carbonyl iron in paraffin wax are reported, together with those of a parallel-plate medium using this material. A shorter theoretical and experimental examination of propagation in a gyromagnetic medium (a magnetized ferrite) is also given. F.F.Roberts

538.566

7209. ON THE EDGE CONDITION IN DIFFRACTION PROBLEMS. P.Poincelot.
C.R. Acad. Sci. (Paris), Vol. 246, No. 24, 3324-5 (June 16, 1958). In French.

Cf. Abstr. 5976 (1950).

538.566 : 537.533 : 621.372.81

ELECTRON WAVES IN PERIODIC WAVEGUIDE STRUCTURES. SPATIAL HARMONICS AND WAVE MODES. See Abstr. 7094-5

538.566 : 621.396.677

7210. RADIATION FIELD OF AN ELLIPTIC LOOP ANTENNA WITH A CONSTANT CURRENT. S.C.Loh and J.Y.Wong.
Canad. J. Phys., Vol. 36, No. 6, 672-6 (June, 1958).

Expressions for the radiation field are derived for a loop aerial of elliptical shape assuming a uniform current distribution. It is found that the radiation pattern in the plane of the loop depends on both the size and the shape of the aerial. However, for small loops, the radiation pattern is independent of the shape and is essentially circular. Some calculated patterns for loops of different sizes and shapes are presented in order to illustrate the derived results. A.

538.566 : 621.396.677

7211. MEASURED SELF-IMPEDANCE OF A DIPOLE ANTENNA NEAR A CONDUCTING CYLINDER OF ELLIPTICAL CROSS SECTION. J.Y.Wong.
Canad. J. Phys., Vol. 36, No. 7, 855-7 (July, 1958).

The results are presented of an experimental investigation, in which the measurements were carried out for various spacings of the aerial from the cylinder along the major and minor axes, and for four different values of cylinder ellipticity. For a cylinder having a maximum dimension of 0.76 λ it is found that the impedance (resistive and reactive components) is an oscillating function of the aerial-to-cylinder spacing, having a period of approximately one-half wavelength. For spacings greater than one wavelength, the impedance is within 5% of the free-space dipole impedance. A.

538.566 : 534.24

7212. SOME NEW ASPECTS OF THE REFLECTION OF ELECTROMAGNETIC WAVES ON A ROUGH SURFACE. M.A.Biot.
J. appl. Phys., Vol. 28, No. 12, 1455-63 (Dec., 1957).

The reflection of a plane wave from a rough perfect conductor is investigated. The roughness is represented by hemispherical bosses whose radii and mutual distances are small relative to the wavelength. This problem is solved taking into account the electromagnetic interaction of the bosses. Some effects not known before are revealed. For grazing incidence and vertical polarization the known before. For grazing incidence and vertical polarization the interaction has a drastic influence in that it causes a complete phase reversal of the reflected wave; near a 45° incidence the influence of the roughness vanishes. These effects do not occur for horizontal polarization. An approximate treatment for the case of the imperfec conductor is indicated. The analogous case for the acoustic wave is also developed and shows similar behaviour. The effect of the roughness is shown to be equivalent to a boundary condition for the wave equation. Extension of the method to a more general type of roughness, and to the case of statistical and asymmetric shapes and distributions, is briefly discussed. A.

538.566

7213. ON THE REFLECTION OF ELECTROMAGNETIC WAVES ON A ROUGH SURFACE. M.A.Biot.
J. appl. Phys., Vol. 29, No. 6, 998 (June, 1958).

Corrects an error in a previous analysis (see preceding abstract), in which the "roughness parameter" used should be replaced by a quantity equal in magnitude but opposite in sign. On effecting this change it is found that a surface wave also can exist and an expression for its associated propagation constant is given. G.D.Sims

538.566.2 : 537.312.62

7214. CONCERNING THE PROPAGATION OF ELECTROMAGNETIC WAVES IN SUPERCONDUCTORS AND THE ELECTROMAGNETIC RECIPROCITY THEOREMS. G.Lampariello.
R.C. Accad. Naz. Lincei, Vol. 22, No. 3, 302-10 (March, 1957). In Italian.

It is shown that, for harmonic fields, the intensities of the London theory can be expressed in terms of Hertz vector potentials. Analogues of the classical Lorentz and Green reciprocal theorems are also derived. R.A.Newing

538.566.2

7215. CONTRIBUTION OF ATMOSPHERIC PARTIAL REFLECTIONS IN THE EXPLANATION OF THE FIELD RECEIVED AT A GREAT DISTANCE. F.du Castel and P.Misme.
C.R. Acad. Sci. (Paris), Vol. 246, No. 1, 82-4 (Jan. 6, 1958). In French.

Measurements have shown that the atmosphere is permanently horizontally stratified, resulting in the refractive index of the air varying in a rapid manner. An expression is given for the reflection coefficient when allowance is made for the contributions from several stratifications, separated in height. G.M.Brown

538.566.3 : 621.396.8

7216. LIMITING POLARIZATION CURVES FOR RADIO WAVE PROPAGATION IN THE IONOSPHERE. R.N.Singh and Y.S.N.Murty.
Curr. Sci., Vol. 27, No. 5, 161-2 (May, 1958).

Details are given of the calculation by the method of conformal representation of the parameters θ and ψ which specify the polarization of a radiowave propagated through the ionosphere in the presence of the earth's magnetic field. The variations of both θ and ψ with wavelength λ for vertical propagation when the electron density tends to zero are given for different values of the electron collisional frequency, and it is found that the limiting values $\theta = \pm 45°$, $\psi = 0$, are valid only when $\lambda < \lambda_H/3$, where λ_H is the gyromagnetic wavelength. G.M.Brown

538.566.3 : 621.396.8

7217. POLARIZATION OF ATMOSPHERICS.
F.Horner; S.R.Khastgir.
Nature (London), Vol. 181, 1878-9, 1879-80 (June 14, 1958).

The interpretation of a complex type of trace obtained by Khastgir with a twin-channel c.r. direction-finder (Abstr. 4192/1958) receiving atmospherics is questioned by Horner, who believes that the record can be accounted for in terms of the ringing of the tuned circuits of the two amplifiers connected to the crossed-pair of loop aerials on reception of a ground-wave and the echo received after only one ionospheric reflection. Horner therefore doubts the information regarding the polarization of multiple echoes deduced by Khastgir. In his reply, Khastgir refutes Horner's interpretation of the particular record considered, and maintains that a full interpretation of such complex patterns must consider both the ringing of the tuned circuits in the two amplifiers, and the polarization of the ionospheric echoes. G.M.Brown

NUCLEAR AND ATOMIC PHYSICS

APPARATUS. PARTICLE DETECTORS

539.1.07

7218. RESPONSE OF A LARGE SODIUM-IODIDE DETECTOR TO HIGH-ENERGY X-RAYS. J.H.Hubbell.
Rev. sci. Instrum., Vol. 29, No. 1, 65-8 (Jan., 1958).

The response of a 4 in. long by 5 in. diameter sodium iodide crystal to axially-incident X-rays (0.01-8 MeV) was expressed as a 28 by 28 matrix. Measured pulse-height distributions were combined with Monte Carlo calculated distributions for the input data. The matrix was inverted on an automatic computer for ease of application to spectra. The mesh is uniform in the square root of energy, each interval including an entire photopeak. Such a coarse mesh makes the response matrix suitable for the unscrambling of continuous but not line spectra. A.

539.1.07

7219. FLUCTUATIONS IN THE RESPONSE TIME OF GEIGER—MÜLLER COUNTERS. F.Demanins.
Tecn. Ital., Vol. 23, No. 2, 107-14 (March, 1958). In Italian.

The time-lag in a Geiger counter between the incidence of the ionizing agent and the resulting electric signal is studied theoretically in terms of the velocity of propagation of the avalanche along the wire. Experiments to determine the time-lag, and its random variation were carried out on three typical counters using an oscilloscope capable of measuring 10^{-9} sec. The results are in good agreement with the theory. A.E.I. Research Laboratory

539.1.07

7220. A PURE-VAPOUR-FILLED COUNTER TUBE OF LONG LIFE. P.Dietrich.
Z. angew. Phys., Vol. 9, No. 11, 547-50 (Nov., 1957). In German.

A tube with a Cu cathode 55 cm long and 5 cm diameter and having a Ta wire anode is described. It is filled, after evacuation and outgassing, with o-xylol, by breaking a 1 cm^3 ampoule inside the tube. Saturation vapour-pressure is maintained and the liquid replenishes loss of gas during use due to counting. The plateau is from 1200 to 1600 V, and if the anode wire is heated occasionally to drive off contamination the life is 7-8 times that of an ordinary G.M. tube. The vapour causes a high temperature coefficient, but the tube will stand changes of ±10 deg. C without departing from its plateau. It is well suited for coincidence and cosmic ray counting where characteristics of two or more tubes have to remain accurately matched over long periods.

F.T.Farmer

539.1.07

7221. THE WALL EFFECT IN A SPHERICAL IONIZATION CHAMBER. O.F.Nemets.
Ukrayin. fiz. Zh., Vol. 2, No. 2, 101-5 (1957). In Ukrainian.

The magnitude of the effect of recoil proton collisions with the chamber walls is calculated and a formula given for correcting recorded distorted-energy spectra. C.R.S.Manders

539.1.07 : 535.376

7222. ON THE PROBLEM OF ENERGY RESOLUTION IN SCINTILLATION COUNTERS. I. L.S.Kukushkin and A.M.Ratner.
Zh. tekh. Fiz., Vol. 28, No. 2, 345-50 (1958). In Russian.

Assuming a case of ideal optical contact between a cylindrical crystal and the photocathode, a formula is derived for the intensity of light energy of a single scintillation inside the crystal, collected at the base. It is expressed as a fraction of the total energy of that scintillation and given as a function of the coordinates of the point of scintillation. The formula is modified for the case of crystal and photomultiplier with the external photocathode having vaseline as the contact layer, and for the case of a crystal and photomultiplier with an internal photocathode. Corresponding curves of equal intensity are given for a NaI(Tl) crystal for three cases, and are repeated for crystals of other dimensions. It is seen from the graphs that the collected fraction decreases at first with the increase of the distance of the point of scintillation and it starts to increase when the point is near the other end of the crystal. Explanation of the results is given, stressing their influence on the energy resolution.

J.M.Zarzycki

539.1.07 : 535.376

7223. ON THE PROBLEM OF ENERGY RESOLUTION IN SCINTILLATION COUNTERS. II. A.M.Ratner and L.S.Kukushkin.
Zh. tekh. Fiz., Vol. 28, No. 5, 1121-5 (1958). In Russian.

Theoretical curves of energy distribution of γ-rays with pulses from a perfect photomultiplier were constructed, with the help of the results from previous work (see preceding abstract), for the case of γ-rays from Cs^{137}(0.661 MeV) collimated along the axis of a cylindrical NaI(Tl) crystal. Three crystals of various dimensions were considered and the Monte-Carlo method was used in the calculations. Numerical results obtained from the curves and tabulated are discussed with details, indicating the dependence of energy resolution on the Compton distribution of incident quanta and on the scattering in the photomultiplier. J.M.Zarzycki

539.1.07

7224. APPARENT TRACK LENGTH IN NUCLEAR EMULSIONS. T.A.Brody.
An. Inst. Fís., Vol. 1, 19-26 (1955). In Spanish.

539.1.07

7225. PHOTOMETRIC MEASUREMENTS OF IONIZATION IN NUCLEAR EMULSIONS. A.Artom, V.Bisi and C.Gentile.
Ricerca sci., Vol. 28, No. 2, 287-95 (Feb., 1958). In Italian.

Describes a photoelectric device for the measurement of ionizing tracks in nuclear emulsions. The values obtained for masses of charged particles which stop in the emulsion, and the charge spectrum of primary cosmic-rays determined with this apparatus, are in good agreement with results obtained by other methods.

P.Rothwell

539.1.07 : 539.12

CHARGE OF PARTICLES STOPPING IN NUCLEAR EMULSIONS. See Abstr. 6111

539.1.07 : 621.374.32

7226. THE LOGARITHMIC-DIODE COUNTING-RATE METER AND PERIOD METER B.B.Barrow.
Trans Amer. Inst. Elect. Engrs I, Vol. 76, 421-7 (1957) = Commun. and Electronics, No. 32 (Sept., 1957).

Analyses the logarithmic-diode counting-rate meter and the logarithmic-diode period meter, treating the problem of obtaining rapid response to reactor-flux transients while minimizing the spurious fluctuations caused by the random character of neutron detections in a fission counter. A procedure for choosing design parameters is discussed. A.

539.1.07

7227. NEUTRON DETECTORS FOR OPERATION AT 400°C. S.G.Kaufmann and L.E.Pahis.
Nucleonics, Vol. 16, No. 3, 90, 92-3 (March, 1958).

Fission chambers were made with coatings of uranium $\frac{1}{2}$ mg/cm^2 thick evaporated on to 0.017 in. stainless steel disks. The disks were assembled, with a spacing of 0.2 in., inside stainless steel bodies and supported with alumina insulators. The chambers were filled with argon at three atmospheres. The pulse characteristics of the chambers showed no change on heating to 400°C, though when used as a current chamber there was a small change in the background current. R.D.Smith

ELEMENTARY PARTICLES

539.12

7228. ON A CLASSIFICATION OF LIGHT PARTICLES. K.Senba.
Progr. theor. Phys., Vol. 17, No. 3, 519-20 (March, 1957).

In analogy with the Nishijima—Gell-Mann classification for the strong interactions of the strange particles, a leptonic hyper-charge is introduced for the purpose of systematizing the decay processes. Together with lepton number conservation, which suffices to make the observed processes "allowed", it is hoped to use the leptonic charge to prohibit the unobserved processes. The difficulty of neutral counter particles is not encountered. P.K.Kabir

539.12 : 530.145

PARTICLES AND SYMMETRIES. See Abstr. 6635

539.12

7229. SPECULATIONS ON THE MASSES OF PARTICLES. H.Fröhlich.
Nuclear Phys., Vol. 7, No. 2, 148-9 (June [2], 1958).

It is pointed out that the masses of five elementary particles (π, K, Λ, Σ, Ξ) are close to being integral multiples of 137 m_e. The masses of two others (μ,N) can be constructed by bringing in $\sqrt{2}$ as an additional natural number. J.M.Cassels

539.12

7230. ON SCATTERING OF DIRAC PARTICLES BY A SHORT-RANGE FORCE CENTRE TAKING DAMPING INTO ACCOUNT. A.A.Sokolov, I.I.Guseĭnov and B.K.Kerimov.

Zh. éksper. teor. Fiz., Vol. 34, No. 1, 110-12 (1958). In Russian.

Elastic scattering of Dirac particles by a short-range force centre at rest is investigated with the help of the radiation damping theory. A formula is obtained for the effective cross-section. The relation between the phase-shifts of scattering of Dirac and spinless relativistic particles is established according to the damping theory. A.

539.12

7231. ON THE POSSIBILITY OF EXPERIMENTAL OBSERVATION OF DIFFRACTION IN TIME EFFECTS.
J.Goldemberg and H.M.Nussenzveig.
Rev. Mexicana Fíz., Vol. 6, No. 3, 117-26 (July, 1957).

Moshinsky's results (Abstr. 632/1953) on "diffraction in time" in a monochromatic, non-relativistic beam of particles are extended to the case of a rectangular pulse. Besides interference effects of the type studied by Moshinsky there appears also the well-known quantum-mechanical spreading effect. Rise time and monochromaticity requirements seem to preclude the possibility of experimental observation of the interference effects, so that they need not be taken into account in neutron velocity selectors. The detection of the spreading, which is subject to weaker requirements, would provide a direct test of the uncertainty relation. A.

539.12

7232. COMPARISON OF CALORIMETRIC AND IONIZATION MEASUREMENTS OF THE ENERGY FLUX OF SYNCHROTRON GAMMA RAYS. S.P.Kruglov.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1060-2 (1957). In Russian.
English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 817-18 (April, 1958).

The energy flux of 85 MeV γ-rays was determined, both with a lead calorimeter and by measuring ionization as a function of thickness of absorbers of C, Al, Cu and Pb. The methods agree within the errors except for the case of lead. In the second method, the rate of energy loss of electrons in the material is assumed, and further work aims at increasing the accuracy of this quantity, improving the absorption curves and developing a more sensitive calorimeter. A.E.I. Research Laboratory

539.12

7233. CALCULATION OF THE IMAGINARY PART OF THE AMPLITUDE OF THE DELBRUCK EFFECT.
M.Feix, P.Kessler and P.Nicourd.
C.R. Acad. Sci. (Paris), Vol. 246, No. 23, 3226 (June 9, 1958).
In French.

Previously derived expressions (Abstr. 1158/1958) for this quantity are evaluated at 2.62 MeV for four scattering angles. The result is too small to explain a discrepancy between theory and experiment in the scattering of γ-rays from Pb. R.J.N.Phillips

539.12 : 539.18

SMALL ANGLE SCATTERING OF 1.33 MeV AND 1.17 MeV GAMMA RAYS. See Abstr. 6367

539.12 : 530.145

RADIATION CORRECTIONS TO COMPTON EFFECT. See Abstr. 6646

539.12 : 539.165.2

INNER BREMSSTRAHLUNG AND THE MAGNETIC MOMENT OF THE NEUTRINO. See Abstr. 6264

539.12 : 539.165.2

A FOUR-STATE THEORY OF THE NEUTRINO. See Abstr. 6258

539.12 : 539.18

MASS DIFFERENCE T – He^3 AND THE MASS OF THE NEUTRINO. See Abstr. 6361

539.12

7234. ČERENKOV RADIATION OF POLARIZED ELECTRONS.
J.Werle and J.Wrzecionko.
Bull. Acad. Polon. Sci. Sér. Sci. math. astron. phys., Vol. 6, No. 3, 191-4 (1958).

It is shown that, owing to the smallness of the effect, it is not possible to determine the electron polarization by measuring the polarization of Cherenkov radiation. W.A.Hepner

539.12

7235. SCATTERING OF POLARIZED DIRAC PARTICLES ON ELECTRONS. G.W.Ford and C.J.Mullin.
Phys. Rev., Vol. 108, No. 2, 477-81 (Oct. 15, 1957).

The cross-section for electron–electron scattering in which the incident and target electrons have arbitrary spin orientations was evaluated. For the special case in which the spin of the incident electron is polarized along the direction of motion, two different spin effects are obtained. The first of these effects is simply a dependence of the cross-section on the relative spin orientation; the second effect corresponds to an up–down asymmetry in the cross-section. Similar effects were obtained for the scattering of polarized positrons on polarized electrons. The depolarization of electrons and muons in scattering on unpolarized electrons was also considered. For electrons which lose an appreciable fraction of their initial energy in passing through matter, the depolarization is appreciable. If the fractional energy loss is small the depolarization is proportional to the fractional energy loss. For nonrelativistic muons the depolarization which occurs as they are brought to rest in matter is found to be negligible. A.

539.12

7236. THE INFLUENCE OF POLARIZATION ON THE CROSS-SECTIONS OF MØLLER AND BHABHA SCATTERING.
K.Böckmann, G.Kramer and W.R.Theis.
Z. Phys., Vol. 150, No. 2, 201-4 (1958). In German.

Formulae for the differential cross-sections are given for the scattering of longitudinally polarized electrons or positrons by electrons of arbitrary polarization. See preceding abstract and Abstr. 6270/1957. W.A.Hepner

539.12

7237. SCATTERING OF HIGH ENERGY ELECTRONS IN NUCLEAR EMULSION. A.Husain.
Pakistan J. sci. industr. Res., Vol. 1, No. 1, 37-9 (Jan., 1958).

For electrons of energies 6.5, 11.5 and 18.7 MeV the lower end of the recoil energy spectrum agreed with theory. For the larger recoil energies the statistics were not good enough to allow a significant check of the predictions of the three available theories. E.J.Burge

539.12

7238. THEORY OF MULTIPLE SCATTERING OF POLARIZED ELECTRONS. B.Mühlschlegel and H.Koppe.
Z. Phys., Vol. 150, No. 4, 474-96 (1958). In German.

A theory of multiple scattering of polarized fermions on isotropic scattering centres is developed. This enables one to calculate the change of polarization in scattering and also the self-depolarization. P.Roman

539.12

7239. CIRCULAR POLARIZATION OF BREMSSTRAHLUNG FROM HIGH-ENERGY ELECTRONS WITH ARBITRARY POLARIZATION. C.Fronsdal and H.Überall.
Nuovo Cimento, Vol. 8, No. 1, 163-5 (April 1, 1958).

539.12

7240. INVESTIGATION OF THE RADIATION OF AN ELECTRON MOVING IN A MAGNETOACTIVE MEDIUM. V.Ya.Éĭdman.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 131-8 (1958). In Russian.

The spectral and angular distribution of the energy emitted by an electron moving in a magnetoactive plasma is considered. The polarization of this radiation is also examined. A.

539.12

7241. CONTRIBUTION OF RECOIL TO CHARGE DISTRIBUTION OF NUCLEONS. H.Suura.
Phys. Rev., Vol. 108, No. 2, 470-6 (Oct. 15, 1957).

Mean-square radii of the charge distribution of nucleons are obtained in closed form in terms of meson field operators, by applying a certain transformation to a relativistic one-nucleon theory. They are evaluated by using the pion distribution as given by a modified extended-source theory which takes into account part of the recoil energy of the nucleon. Such a theory derives from the original one-nucleon theory as a result of an expansion in inverse-powers of the nucleon mass. The results shows that the radius of the nucleon core, which arises solely from recoil, is much smaller than the one inferred from electron–proton scattering experiments. On the other hand, the recoil correction to the static charge distribution of the pion cloud is negative and so large as almost to cancel the latter. A.

539.12

7242. INTEGRO-DIFFERENTIAL SYSTEM FOR A COLLISION PROBLEM COMPRISING FOUR NUCLEONS. CASE OF STATE WITH TOTAL SPIN 2. P.Burke and W.Laskar.
C.R. Acad. Sci. (Paris), Vol. 246, No. 21, 3044-7 (May 28, 1958).
In French.

The collision of two groups of particles (12,34), (1,324) or (2,413) is studied, assuming that, in addition to a repulsive Coulomb interaction (with exchange) between the particles 2 and 4, there is a

similar central interaction between each pair of particles. Using a wave-function showing Wheeler's resonating group structure and taking account of the Pauli exclusion principle, a variational method leads to a system of integro-differential equations. After summation over spins and integration over internal and angular variables, these reduce to a single radial integro-differential equation.

M.J.Kearsley

539.12

7243. INTEGRO-DIFFERENTIAL SYSTEM FOR A COLLISION PROBLEM COMPRISING FOUR NUCLEONS. CASE OF STATES WITH TOTAL SPIN 0 AND 1. P.Burke and W.Laskar.
C.R. Acad. Sci. (Paris), Vol. 246, No. 22, 3158-61 (June 2, 1958).
In French.

Employing the methods developed in a previous note (see preceding abstract) the integro-differential system of equations is derived for the case of states with total spin 0 and 1, for the collision of two groups of particles interacting with a repulsive Coulomb interaction with exchange. M.J.Kearsley

539.12

7244. ON THE DIFFERENCE OF π^0-NUCLEON AND $\pi^\pm$-NUCLEON COUPLING CONSTANTS. Riazuddin.
Nuclear Phys., Vol. 7, No. 3, 223-4 (June [3], 1958)

In a preceding paper (Abstr. 5201/1958), the effect of the $\pi^\pm-\pi^0$ mass difference on the scattering lengths a_{np} and a_{pp} for neutron—proton and proton—proton scattering was estimated and found to give a larger contribution than is required to explain the difference between the two scattering lengths. To obtain agreement with experiment, it was proposed in Abstr. 5201 (1958) that the π^0-coupling constant should be taken 1.5% larger than the $\pi^\pm$-coupling constant. In this note, it is shown that in second-order perturbation theory the π^0-coupling constant is indeed greater than the $\pi^\pm$-coupling constant. P.K.Kabir

539.12 : 539.18

NUCLEON—NUCLEON SPIN—ORBIT POTENTIALS. See Abstr. 6352

539.12

7245. POSSIBLE NEW ISOBARIC STATE OF THE PROTON. R.R.Wilson.
Phys. Rev., Vol. 110, No. 5, 1212-13 (June 1, 1958).

The hypothesis of a strong resonant meson—nucleon interaction, in a state with isotopic spin $\frac{1}{2}$ and angular momentum 3/2 at a c.m. energy of about 600 MeV, is compared with experimental data in the region 500-1000 MeV, mostly on the photoproduction of π-mesons, and the qualitative agreement is claimed to be "rather striking". P.K.Kabir

539.12

7246. DIFFRACTION SCATTERING OF HIGH-ENERGY PROTONS BY PROTONS. V.G.Grishin and I.S.Saitov.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1051-3 (1957). In Russian.
English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 809-11 (April, 1958).

Analyses p—p scattering data at 1.5 and 2.75 GeV by means of an optical description of the nucleon. J.M.Cassels

539.12

7247. APPLICATION OF THE LOW INTEGRAL EQUATION METHOD TO THE PROBLEM OF PROTON—PROTON SCATTERING. F.M.Kuni.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 163-72 (1958). In Russian.

An integral equation of the Low type is derived and investigated in relation to the proton—proton scattering problem. The connection with the phenomenological quantum theory treatment of proton—proton scattering is established. It is shown that the total scattering cross-section observed in the medium energy region can be obtained by solving the derived equation and taking into account only the most intense scattered wave $^1S_0$, providing that the contribution of states involving, besides two nucleons, also a number of real mesons and nucleon—antinucleon pairs is neglected in the equation; moreover it must be assumed that the inhomogeneous term of the equation is computed in the non-relativistic single-meson approximation. A.

539.12 : 539.14

ELASTIC SCATTERING AND POLARIZATION OF FAST PROTONS BY NUCLEI. See Abstr. 6207

539.12 : 539.17

INELASTIC SCATTERING OF 185 MeV PROTONS. See Abstr. 6295

539.12

7248. POLARIZATION OF 635 MeV PROTONS BY DEUTERONS IN QUASI-ELASTIC P—P SCATTERING. Yu.P.Kumekin.
Zh. éksper. teor. Fiz., Vol. 33, No. 4, 1056-7 (1957). In Russian.
English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 813-14 (April, 1958).

The polarization, measured at five angles, does not differ from that observed in ordinary p—p scattering. This was expected in view of the high energy of the incident proton. J.M.Cassels

539.12 : 539.17

POLARIZATION OF PROTONS FROM THE d—d REACTION See Abstr. 6305

539.12

7249. ELASTIC SCATTERING OF ANTI-PROTONS ON CARBON FROM 30-200 MeV. L.E.Agnew, Jr, T.Elioff, W.B.Fowler, L.Gilly, R.Lander, L.Oswald, W.M.Powell, E.Segrè, H.M.Steiner, H.S.White, C.Wiegand and T.Ypsilantis.
Phys. Rev. Letters, Vol. 1, No. 1, 27-9 (July 1, 1958).

Seventy elastic scatterings $> 5^\circ$ were observed in 179 metres of antiproton track in a liquid propane bubble chamber. The high ratio of antiproton cross-sections to proton cross-sections observed at higher energies is again found. The angular distribution is fitted by an optical model using well-depth parameters derived from the Ball—Chew model for nucleon—antinucleon scattering.

S.J.Goldsack

539.12

7250. ANTIPROTON ANNIHILATION INTO NEUTRAL PIONS. G.M.Frye, Jr.
Phys. Rev. Letters, Vol. 1, No. 1, 14-16 (July 1, 1958).

An antiproton was brought to rest in a nuclear emulsion stack. Its only visible annihilation product was a single electron pair.

S.J.Goldsack

539.12

7251. MEASUREMENTS OF ASYMMETRIES IN THE DECAY OF POLARIZED NEUTRONS.
M.T.Burgy V.E.Krohn, T.B.Novey, G.R.Ringo and V.L.Telegdi.
Phys. Rev., Vol. 110, No. 5, 1214-16 (June 1, 1958).

The result of a measurement of the directional correlation between the neutron spin and the neutrino momentum in neutron decay is $\mathcal{B} = 0.88 \pm 0.15$ and the same apparatus gives an improved value of $\alpha = -0.09$ for the correlation between neutron spin and beta-particle momentum. Taken in conjunction with other results, these values suggest that this beta-decay interaction is a mixture of vector and axial vector with coupling constants approximately equal in magnitude but opposite in sign. A.E.I. Research Laboratory

539.12 : 539.17

7252. THERMAL-NEUTRON DATA FOR THE ELEMENTS.
M.V.Davis and D.T.Hauser.
Nucleonics, Vol. 16, No. 3, 87-9 (March, 1958).

Nucleonics data sheet No. 23. A tabulation of microscopic and macroscopic cross-sections, mean free paths, resonance integrals, diffusion coefficients and diffusion lengths. R.D.Smith

539.12

7253. ELASTIC SCATTERING OF 580 MeV NEUTRONS BY PROTONS IN THE LOW-ANGLE REGION.
N.S.Amaglobeli and Yu.M.Kazarinov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 53-7 (1958). In Russian.

The differential cross-sections for scattering of 580 MeV neutrons by protons into angles of 11, 23 and 35° (c.m.s.) were measured. A rapid rise of the cross-sections with decrease of the scattering angle was observed. The results indicate that the probabilities for scattering in the "forward" and "backward" directions are approximately equal. A.

539.12

7254. ON POLARIZATION OF SLOW NEUTRONS SCATTERED IN CRYSTALS. S.V.Maleev.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 129-30 (1958). In Russian.

Formulae are derived for the cross-sections and polarization of slow neutrons scattered in crystals with polarized nuclei. A.

539.12

7255. ON WICK'S PROBLEM. M.V.Maslennikov.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 1, 59-62 (1958). In Russian.

The problem formulated by Wick (Abstr. 2745, 1949), on the slowing down of neutrons, is re-stated to apply to a general source and moderator. Formulae are presented describing the asymptotic neutron density and energy spectrum at large distances from the source. J.W.Gardner

539.12 : 539.17

POLARIZATION OF $Li^7(p,n)Be^7$ NEUTRONS. See Abstr. 6294

539.12

7256. ANTINEUTRON PRODUCTION BY CHARGE EXCHANGE. J.Button, T.Elioff, E.Segrè, H.M.Steiner, R.Weingart, C.Wiegand and T.Ypsilantis.
Phys. Rev., Vol. 108, No. 6, 1557-61 (Dec. 15, 1957).

Antineutrons produced by 440 MeV antiprotons incident upon Pb, C, and CH_2 targets were observed. The antineutrons were detected by their energy release upon annihilation. Charge-exchange cross-sections for antiprotons in the three targets were calculated. The results show that the effective charge-exchange cross-section per proton of the target nucleus decreases rapidly with increasing Z. A.

539.12

7257. MESONS AND THE STRUCTURE OF NUCLEONS. II. THE NUCLEON ISOBAR AND PION DYNAMICS. B.T.Feld.
Ann. Phys. (New York), Vol. 4, No. 2, 189-232 (June, 1958).

For previous part, see Abstr. 8997 (1957). An "atomic" model of the physical nucleons is extended to describe the excited isobar nucleon state, of angular momentum and isotopic spin 3/2. The model is used to compute the cross-sections for resonant photoproduction of pions and Compton scattering of photons on protons. Other, nonresonant processes are taken into account in a phenomenological fashion, and the computed cross-sections for the aforementioned processes are compared with available experimental data. The model is also used as a guide for the phenomenological interpretation of other high-energy processes — in particular, photodisintegration of the deuteron in the region of the photomeson threshold, and the resonant π^--P interaction at ~ 1 BeV. A.

539.12

7258. SOME IDENTITIES FOR RENORMALIZATION CONSTANTS IN S(S) AND PS(PS) MESON THEORIES. K.Hiida.
Prog. theor. Phys., Vol. 17, No. 3, 520-1 (March, 1957).

Using the approach of Landau, Abrikosov and Khalatnikov (Abstr. 7966-8/1956), relations are found between the renormalization constants: (a) they are equal for S(S) and PS(PS) theories; and (b) Ward identities exist for neutral meson theories.

P.K.Kabir

539.12

7259. ON THE MULTIPLE MESON PRODUCTION IN NUCLEON–NUCLEON COLLISIONS AND IN NUCLEON–ANTINUCLEON ANNIHILATION. M.Kretzschmar.
Z. Phys., Vol. 150, No. 3, 247-63 (1958). In German.

These processes are investigated in the framework of Fermi's statistical theory, fixing the arbitrary parameter so as to give correctly the mean energy of the annihilation pions in $p + \bar{p}$. The results are in good agreement with experiments and moreover the meson production data in the nucleon–nucleon collision processes become better than they were in the original calculations.

P.Roman

539.12 : 530.145

7260. DECAYS OF THE μ MESON IN THE INTERMEDIATE-MESON THEORY. G.Feinberg.
Phys. Rev., Vol. 110, No. 6, 1482-3 (June 15, 1958).

If, as suggested by Feynman and Gell-Mann (Abstr. 507/1958), the universal Fermi interaction arises from the exchange of a heavy charged boson, the radiative decay of the μ-meson, $\mu \rightarrow e + \gamma$, is a process of order $G^2\alpha$, where G is the Fermi coupling constant, and therefore much more probable than if only direct four-fermion couplings exist, in which case it would be at least of order $G^4\alpha$. For intermediate vector mesons with the "normal" magnetic moment of one magneton, the lowest order perturbation calculation contains a logarithmically divergent integral and yields a branching ratio,

$$P = R(\mu \rightarrow e + \gamma)/R(\mu + e + \nu + \bar{\nu}),$$

of 10^{-4} if a Feynman cut-off at the meson mass is used; if the meson is given a magnetic moment of 2 magnetons, the result is convergent and again equal to 10^{-4}. The observed branching ratio is less than 2×10^{-8}, so this would appear to pose a serious difficulty for the intermediate meson theory, unless explicit selection rules exist forbidding the decay $\mu \rightarrow e + \gamma$. P.K.Kabir

539.12

7261. PRECISE MEASUREMENTS OF MUON MAGNETIC MOMENTS BY "STROBOSCOPIC COINCIDENCES". R.A.Lundy, J.C.Sens, R.A.Swanson, V.L.Telegdi and D.D.Yovanovitch.
Phys. Rev. Letters, Vol. 1, No. 1, 38-40 (July 1, 1958).

A new method of measuring the frequency of precession of mu-mesons in a magnetic field is used to determine its magnetic moment. The gyromagnetic ratios in two experiments at different magnetic fields are:

$g_\mu = 2(1.0015 \pm 0.0006)$ at 3.700 gauss and
$g_\mu = 2(0.9993 \pm 0.0042)$ at 300 gauss. S.J.Goldsack

539.12

7262. LEPTONIC GAUGE TRANSFORMATION AND CHARGE CONSERVATION. E.C.G.Stueckelberg.
Arch. Sci. (Geneva), Vol. 10, No. 2, 243-7 (April-June, 1957). In French.

Gives a field-theoretical description of $\pi \rightarrow \mu + \nu$ decay (by direct interaction), to illustrate leptonic charge conservation and associated gauge transformations. R.J.N.Phillips

539.12

7263. NEW RESULTS IN THE STUDY OF THE DISINTEGRATION CHAIN $\pi^+ - \mu^+ - e^+$. H.Hulubei, J.Auslander, E.Balea, E.Friedländer and S.Titeica.
C.R. Acad. Sci. (Paris), Vol. 246, No. 15, 2197-200 (April 14, 1958). In French.

Extending previous work (Abstr. 280/1958) to a further 7526 $\pi-\mu$ decays, the authors find marked anisotropies in the angle of emission of the μ^+-meson with respect to the direction of the incident π^+ (χ^2 probability $\ll 10^{-5}$). The angular distribution of the electrons from the subsequent μ-meson decay is also found to depend on the direction of emission of the μ-meson. S.J.Goldsack

539.12

7264. SOME EXPERIMENTAL RESULTS ON THE ANGULAR CORRELATIONS IN THE $\pi-\mu-e$ DECAY. J.K.Bøggild, K.H.Hansen and M.Scharff.
Nuovo Cimento, Vol. 8, No. 5, 767-9 (June 1, 1958).

In view of the poor consistency between observations by different workers on the asymmetry in $\pi-\mu-e$ decay, an analysis is made of 796 such events in photographic emulsions exposed at 30 km over South England; the material was divided into seven groups and again the consistency between different observers was poor. An unsuccessful attempt is made to account for the lack of consistency on the basis of a neglected physical effect correlating the asymmetry with the direction of the particles producing the π-mesons.

P.K.Kabir

539.12

7265. BETA DECAY OF THE PION. J.C.Taylor.
Phys. Rev., Vol. 110, No. 5, 1216-18 (June 1, 1958).

If the axial vector part of the baryon and meson current in Fermi interactions were divergenceless, then the decay of the pion would be forbidden. J.C.Taylor

539.12

7266. ANGULAR CORRELATIONS OF $\pi^+ - \mu^+ - e^+$-DECAYS IN A PROPANE BUBBLE CHAMBER. V.V.Barmin, V.P.Kanavets, B.V.Morozov and I.I.Pershin.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 830-5 (1958). In Russian.

The result of projective treatment of 6760 $\pi^+ - \mu^+ - e^+$-decay events photographed in a two-litre propane bubble chamber is considered. Assuming the angular distribution of decay positrons to be described by the formula $1 + a\cos\theta$ it is found that $a_{prop} = -0.19 \pm 0.03$. This result confirms Lee and Yang's hypothesis of nonconservation of parity in weak interactions. A.

539.12

7267. EQUATION OF THE $\pi^\pm$ TRAJECTORY IN THE ELECTROMAGNETIC FIELD. M.Zăgănescu.
C.R. Acad. Sci. (Paris), Vol. 246, No. 17, 2459-61 (April 28, 1958). In French.

The classical equations of a charged meson field, interacting with a static electric field and (non-linearly) with itself, are studied. R.J.N.Phillips

539.12

7268. ON THE INTERACTION BETWEEN K-MESONS, PIONS, NUCLEONS, AND HYPERONS. V.S.Barashenkov.
Nuclear Phys., Vol. 7, No. 2, 146-7 (June [2], 1958).

The statistical theory of production of these particles in high-energy collisions is discussed in the light of the experimental results. J.M.Cassels

539.12

7269. MESON–MESON INTERACTION IN THE BETHE–SALPETER APPROXIMATION. A.N.Mitra and R.P.Saxena.
Phys. Rev., Vol. 108, No. 4, 1083-9 (Nov. 15, 1957).

The $\pi-\pi$ interaction is studied in the Bethe–Salpeter

approximation by first obtaining the "effective" interaction Hamiltonian with the help of the lowest order S-matrix for $\pi-\pi$ scattering. This Hamiltonian is then used to set up a Goldberger-type integral equation for $\pi-\pi$ scattering which is solved for the cases of total isotopic spins I = 0, 2, assuming the mesons to be in s-states with respect to each other. It is found that the interaction in the state I = 0 is too strongly attractive to give a resonance. On the other hand, a resonance is obtained for the case I = 2, at a momentum (in the centre-of-mass system) k ~ 93 MeV/c for each meson, taking $G^2/4\pi = 15.5$. A.

539.12 : 530.145

7270. CONSEQUENCES OF A PSEUDOVECTOR PION—NUCLEON COUPLING AND THE UNIVERSAL β-DECAY.
R.E.Norton and W.K.R.Watson.
Phys. Rev., Vol. 110, No. 4, 996-7 (May 15, 1958).

On the assumption that the pion—nucleon coupling is pseudovector, the bare mass of the pion may be calculated from the pion lifetime. A preliminary estimate is 200 electron masses. This result would be marred if it were found to be impossible to include hyperons as well as nucleons. J.C.Taylor

539.12

7271. NEW DISPERSION RELATIONS FOR PION—NUCLEON SCATTERING. W.Gilbert.
Phys. Rev., Vol. 108, No. 4, 1078-83 (Nov. 15, 1957).

New relations expressing the imaginary part of the scattering amplitude as a coupling-constant term and an integral over the physical spectrum of the real part of the amplitude are developed. These relations are applied to compute the meson-nucleon coupling constant from the experimental phase shifts, yielding the value $f^2 = 0.084$, and are used to compute the s-wave scattering lengths from the p-wave data. A.

539.12

7272. ELASTIC SCATTERING OF $\pi^{\pm}$ MESONS BY HELIUM NUCLEI AT 300 MeV.
M.S.Kozodaev, R.M.Sulyaev, A.I.Filippov and Yu.A.Shcherbakov.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1047-9 (1957). In Russian.
English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 806-7 (April, 1958).

A study of the small-angle scattering shows that the nuclear interaction is repulsive. A left—right asymmetry in the π^+ scattering appears to be significant; this would imply that the pion is polarized and therefore has non-zero spin. J.M.Cassels

539.12

7273. APPLICATION OF DISPERSION RELATIONS TO $\pi-N$ SCATTERING AT LOW ENERGIES. L.I.Lapidus.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 453-62 (1958). In Russian.

Consequences of the dispersion relations for $\pi-N$ scattering at low energies are considered without making recourse to the Low-type equations. Relations between the scattering lengths in various states are deduced from the derivatives of the dispersion relations at $k^2 = 0$. A.

539.12

7274. PHOTOPRODUCTION OF POSITIVE PIONS FROM PROTONS.
J.L.Uretsky, R.W.Kenney, E.A.Knapp and V.Perez-Mendez.
Phys. Rev. Letters, Vol. 1, No. 1, 12-14 (July 1, 1958).

Measurements were made at 260 MeV and 290 MeV of the angular distribution of the pions from the process $\gamma + p \rightarrow \pi^+ + n$ between 0^0 and 150^0. Theoretical calculations are performed based on the dispersion-relation formulae given by Chew. It is found that the results of the calculations are very sensitive to the choice of values for the "small" pion—nucleon scattering phase-shifts.

S.J.Goldsack

539.12

7275. THEORY OF PHOTOPRODUCTION AND SCATTERING OF π-MESONS ASSUMING STRONG COUPLING. I.
Yu.V.Tsekhmistrenko.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 21-31 (1957). In Ukrainian, with summaries (1 p.) in Russian and ($\frac{1}{2}$ p.) in English.

Pekar's strong-coupling theory (Abstr. 4835, 4836, 8593/1956) is used in the calculation of the effective cross-sections of charged and neutral π-meson photoproduction on nucleons. Qualitative agreement is found between the author's theoretical and other workers' experimental results. C.R.S.Manders

539.12

7276. THEORY OF PHOTOPRODUCTION AND SCATTERING OF π-MESONS ASSUMING STRONG COUPLING. II.
Yu.V.Tsekhmistrenko.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 32-42 (1957). In Ukrainian, with summaries ($\frac{1}{2}$ p.) in Russian and ($\frac{1}{2}$ p.) in English.

The theory developed in Pt I (see preceding abstract) is examined further and found to be consistent and non-contradictory. It is shown that the theoretical values of the nucleon mean magnetic-moment, the photoproduction cross-section near threshold, and the scattering cross-section at low energies, are of the same order as those found by experiment. C.R.S.Manders

539.12

7277. THE SCATTERING AND ABSORPTION OF γ-QUANTA BY NUCLEONS IN STRONG COUPLING THEORY.
Yu.V.Tsekhmistrenko.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 59-60 (1957). In Ukrainian.

Supplementary note to the two preceding abstracts.

C.R.S.Manders

539.12

7278. π-MESON PRODUCTION BY π^--MESONS ON HYDROGEN NEAR THE THRESHOLD. V.G.Zinov and S.M.Korenchenko.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 301-10 (1958). In Russian.

Production of π-mesons on hydrogen by 307, 333 and 370 MeV π^--mesons was studied with scintillation counters. The differential cross-section for production at an angle of 80^0 in the laboratory system (106^0 c.m.s.) of a charged meson in any of the processes $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ or $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ is $(0.10 \pm 0.06) \times 10^{-27}$ cm^2 sterad^{-1} for $E_{\pi^-} = 307$ MeV, $(0.17 \pm 0.06) \times 10^{-27}$ cm^2 sterad^{-1} for $E_{\pi^-} = 333$ MeV and $(0.29 \pm 0.05) \times 10^{-27}$ cm^2 sterad^{-1} for $E_{\pi^-} = 370$ MeV. A.

539.12

7279. PROPERTIES OF NEGATIVE K-MESONS.
F.H.Webb, E.L.Iloff, F.H.Featherston, W.W.Chupp, G.Goldhaber and S.Goldhaber.
Nuovo Cimento, Vol. 8, No. 6, 899-921 (June 16, 1958).

An analysis of interactions of 420 MeV/c K^--mesons incident on a nuclear emulsion stack was carried out. By following K^--mesons along the track, information was obtained on the interaction of K^--mesons in flight and at rest. The differential scattering cross-section was fitted with diffraction scattering off a black disk with radius $1.32 \times A^{\frac{1}{3}}$ fermis in agreement with the total reaction cross-section. A compilation of K^-—H elastic scattering and absorption events is presented, giving cross-sections of σ_{KH} (scattering) = $= (48.4^{+15}_{-11})$ mb and σ_{KH} (absorption) = 11.4^{+9}_{-6} mb. The inelastic scattering of K^--mesons in complex nuclei was found to be only 4% of the absorption cross-section. The average energy losses in K^- inelastic scattering events is ~ 50% of the incident K energy, in contrast to a 25% loss for K^+ inelastic scattering. In the course of this work a number of decays in flight were observed. Combining these with earlier data, a mean life of $\tau_{K^-} = (1.3^{+0.4}_{-0.3}) \times 10^{-8}$ sec was obtained. Some of the secondaries from decays in flight were identified, namely $2\,K_{\pi 2}$, $2\,K_{\mu 3}$, and $1\,K_{e3}$. From K^-—H absorption events a Σ^-—Σ^+ mass difference of $(13.9 \pm 1.8)\ m_e$ and a value of the K^- mass of $(966.7 \pm 20)\ m_e$ were obtained. From an analysis of the charged pion spectrum obtained from K^- interactions at rest, it was possible to calculate the ratio of Λ to Σ hyperons produced in the primary interaction. It was found that in the primary K^- nucleon absorption reaction, Σ-hyperon formation dominates over Λ-hyperon formation. An energy and strangeness balance shows that 70% of the K^- stars at rest emit a Λ-particle. This means that about 60% of the Σ-hyperons that are produced are converted to Λ-hyperons inside the nucleus in which they were formed. A.

539.12

7280. CONCERNING A SYMMETRY PROPERTY OF THE NEW GELL-MANN THEORY. Chzhou Gaun-Chzhao.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1058-9 (1957). In Russian.
English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 815-16 (April, 1958).

It is shown that Gell-Mann's (Abstr. 7408/1957) theory of global interactions possesses additional symmetries which, for example, forbid the decay $\pi^0 \rightarrow 2\gamma$ through baryon loops in which case, presumably, this decay takes place through K interactions only. A similar prohibition occurs for the beta-decay (radiative or non-radiative) of the pion in the case of T-interaction. P.K.Kabir

539.12

7281. DECAY OF K MESONS AS A TEST OF THE UNIVERSAL FERMI INTERACTION. F.Zachariasen.
Phys. Rev., Vol. 110, No. 6, 1481-2 (June 15, 1958).

The ratio of K_{e3} to $K_{\mu 3}$ decays, at a fixed pion energy, is proposed as a test for the universal V ± A coupling hypothesis. The total ratio, independent of pion energy, is consistent with experiment. P.K.Kabir

539.12

7282. DIVERGENCELESS CURRENTS AND K-MESON DECAY. S.Weinberg, R.E.Marshak, S.Okubo, E.C.G.Sudarshan and W.B.Teutsch.
Phys. Rev. Letters, Vol. 1, No. 1, 25-7 (July 1, 1958).

An experiment is suggested to test directly whether the currents in the weak interactions are divergenceless, independent of one's ability to write down the form of such a current. A unique prediction of the angular distribution in $K_{\mu 3}$ and K_{e3} decays comes from the divergenceless assumption, and its confirmation would provide strong support for the ideas of Feynman and Gell-Mann.
G.H.Burkhardt

539.12

7283. SCATTERING OF K^+ MESONS IN PHOTOGRAPHIC EMULSION. T.G.Lim.
Ned. Tijdschr. Natuurkde, Vol. 24, No. 6, 156-9 (June, 1958). In Dutch.

A review of the possible types of interaction of the K^- mesons and of the data available on these interactions. J.M.Hough

539.12

7284. ASSOCIATED PHOTOPRODUCTION OF K AND Λ PARTICLES AND POSSIBLE "UP–DOWN" ASYMMETRY IN THE Λ DECAY. J.J.Sakurai.
Phys. Rev., Vol. 108, No. 2, 491-3 (Oct. 15, 1957).

The possibility of detecting parity nonconservation in the decay of a Λ particles produced by the reaction $\gamma + p \rightarrow \Lambda^0 + K^+$ is discussed. The photoproduction matrix is studied from a phenomenological point of view, and the conditions essential for the detection of an "up–down" asymmetry are examined. A.

539.12

7285. PHOTOPRODUCTION OF K^+ PARTICLES IN HYDROGEN AT FORWARD ANGLES.
H.M.Brody, A.M.Wetherell and R.L.Walker.
Phys. Rev., Vol. 110, No. 5, 1213-14 (June 1, 1958).

Cross-sections for the reaction $\gamma + p \rightarrow K^+ + \Lambda^0$ were measured at two angles for a photon energy of 1000 MeV. J.M.Cassels

539.12

7286. A VARIANT OF THE THEORY OF HYPERONS.
Ya.B.Zel'dovich.
Zh. éksper. teor. Fiz., Vol. 33, No. 3(9), 829-31 (1957). In Russian.

Hyperons are assumed to be compounds of nucleons and $\bar{K}$ mesons, and a semi-empirical mass formula is fitted to the known masses of Λ and Σ hyperons. The mass of the Ξ hyperon is then predicted, in fair agreement with experiment. A series of hyperons with other strangenesses are also predicted. J.W.G.Wignall

539.12

7287. PROTONIC Σ-DECAY WITH AN ASSOCIATED ELECTRON PAIR. A.G.Ekspong and S.Nilsson.
Phys. Rev. Letters, Vol. 1, No. 1, 36-8 (July 1, 1958).

An unusual event is described, for which no really satisfactory interpretation can be given. G.H.Burkhardt

539.12

7288. ON THE Σ-HYPERON–NUCLEON INTERACTION CROSS-SECTION. II. F.Ferrari and M.Tonin.
Nuovo Cimento, Vol. 7, No. 1, 123-7 (Jan. 1, 1958).

The apparent discrepancy in the ratios of neutral to charged hyperon production in K^- capture by nucleons and by complex nuclei, can be explained by interactions of the hyperons inside the nucleus (see Abstr. 9415/1957). To fit the observed results with reasonable values for the hyperon–nucleon interaction cross-sections, it is necessary to assume that the hyperons move in an average potential of 10-20 MeV inside the nucleus.
S.J.Goldsack

539.12

7289. PHOTOPRODUCTION OF STRANGE PARTICLES.
S.G.Matinyan.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1063-4 (1957). In Russian. English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 819-20 (April, 1958).

Brueckner's treatment of the photo-production of π-mesons (Abstr. 82/1951) is extended to strange particles and yields equations of identical form for the ratios of cross-sections of the relevant reactions. E.J.Burge

539.12

7290. PHOTOPRODUCTION OF STRANGE PARTICLES ON PROTONS. V.I.Mamasakhlisov, S.G.Matinyan and M.E.Perel'man.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 195-7 (1958). In Russian.

Photoproduction of strange particles on protons is considered for the case of hyperon spins of 1/2 and 3/2. The angular distribution of K-mesons is derived. Comparison of these distributions with experiment permits one to determine the parity of the (KY)-system with respect to the nucleon. A.

539.12 : 530.145

7291. ANALYTIC FORMS OF THE DEUTERON WAVE FUNCTION. M.J.Moravcsik.
Nuclear Phys., Vol. 7, No. 2, 113-15 (June [2], 1958).

Gives analytic approximations to the deuteron wave-function of the Gartenhaus potential (Abstr. 921/1956). R.J.N.Phillips

NUCLEUS

539.14

7292. PROCEEDINGS OF THE REHOVOTH CONFERENCE ON NUCLEAR STRUCTURE 1957. Edited by H.J.Lipkin.
Amsterdam: North-Holland Publishing Company; New York: Interscience Publishers (1958) 600 pp.

This international conference was held in September 1957 at the Weizmann Institute of Science, Rehovoth, Israel. The following topics were discussed: Shell model evidence in nuclei; the unified model; the seniority quantum number; electromagnetic transitions and heavy nuclei; finite size effects; beta-decay and parity; angular correlation; experimental techniques; measurement of short lifetimes. A report on the conference is given in Science, Vol. 127, 601-4 (March 14, 1958).

539.14

7293. NEUTRON SEPARATION ENERGIES AND PAIRING ENERGIES FOR HEAVY NUCLEI. W.H.Johnson, Jr and V.B.Bhanot.
Phys. Rev., Vol. 107, No. 6, 1669-73 (Sept. 15, 1957).

A 6 in. double-focusing mass spectrometer was employed to determine 32 mass differences between neighbouring isotopes of even-Z elements in the region from Z = 64 to 82. Neutron separation energies and neutron pairing energies are easily calculated from the experimental results. These calculated values are sufficiently precise to conclude that lack of uniformity in neutron separation energy and pairing energy systematics appears in regions where other nuclear properties exhibit changes in their systematics. Neutron separation energy data were employed for the isotopic assignments of several nuclear reactions. A.

539.14 : 530.145

7294. SPIN–ORBIT CONTRIBUTIONS IN THE LOW-ENERGY n–p TRIPLET POTENTIALS. R.G.Newton and J.H.Scofield.
Phys. Rev., Vol. 110, No. 3, 785-6 (May 1, 1958).

The triplet n–p potentials of Newton and Fulton (see Abstr. 5204/1958) are modified to restore the deuteron magnetic moment to its correct value, while retaining a spin–orbit potential.
G.H.Burkhardt

539.14 : 539.17

RELATION OF SCATTERING PHASES TO INTERACTION PARAMETERS. See Abstr. 6286

539.14 : 539.17

THE INTERACTION OF TWO ALPHA-PARTICLES. See Abstr. 6311

539.14

7295. THE MANY-PARTICLE PROBLEM IN NUCLEAR PHYSICS. N.M.Hugenholtz.
Ned. Tijdschr. Natuurkde, Vol. 24, No. 4, 81-98 (April, 1958). In Dutch.

A review discussing the shell and optical models, the Hartree–Fock approximation, Brueckner's treatment and its consequences and validity. E.P.Wohlfarth

539.14 : 530.145

S-MATRIX POLES IN THE OPTICAL NUCLEAR MODEL CASE. See Abstr. 6638

539.14

7296. ON THE QUASI-STATIONARY STATES OF THE NUCLEUS. O.M.Korol'ov.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 369-71 (1957). In Ukrainian.

Theoretical paper which attempts to harmonize the work over the last three years by Bohr, Brink, Loshida, Heitler, Blatt and Biedenharn, Zaretskii and Shut'ko. C.R.S.Manders

539.14

7297. SPINS OF CERTAIN SHORT-LIVED Cu AND Ag ISOTOPES. J.B.Reynolds, R.L.Christensen, D.R.Hamilton, W.M.Hooke and H.H.Stroke.
Phys. Rev., Vol. 109, No. 2, 465-70 (Jan. 15, 1958).

The spins were measured by the atomic-beam method. Spin values are as follows: Cu^{60}, I = 2; Cu^{61}, I = $\frac{3}{2}$; 27-minute Ag^{104}, I = 2; 24-minute Ag^{106}, I = 1; and I = 2 for a 1.2-hr Ag activity, the identity of which is not certain, but which may be attributed to Ag^{102} or Ag^{103}. A.

539.14

7298. POSSIBLE METHOD OF INVESTIGATING GYROMAGNETIC RATIOS OF SHORT-LIVED NUCLEAR STATES WITH FAST NEUTRAL BEAMS.
L.E.Beghian, R.P.Scharenberg, P.H.Rose and R.W.Waniek.
Phys. Rev., Vol. 110, No. 6, 1479 (June 15, 1958).

In investigating gyromagnetic ratios, very high magnetic fields are required to cause the appreciable precession of the axis of symmetry of the decaying nucleus. Fields of the order of 300 000 G can be obtained from pulsed magnets, but these would appreciably deflect incident charged particles. It is proposed that in order to overcome this difficulty beams of atomic hydrogen could be used. These would be stripped on entering the target material and the range of the resultant proton is so short that it would experience only slight deflection. 1 MeV atomic hydrogen beams were produced by allowing 2 MeV singly charged molecular hydrogen beams to pass through a hydrogen gas stripper.

A.E.I. Research Laboratory

539.14

7299. NUCLEAR SPIN OF ASTATINE-211.
H.L.Garvin, T.M.Green, E.Lipworth and W.A.Nierenberg.
Phys. Rev. Letters, Vol. 1, No. 2, 74-5 (July 15, 1958).

The nuclear spin of 7.2 hour At^{211} was determined as 9/2 by an atomic beam method. L.L.Green

539.14

7300. MEASUREMENT OF NUCLEAR MAGNETIC MOMENTS IN ATOMIC BEAMS. G.K.Woodgate and P.G.H.Sandars.
Nature (London), Vol. 181, 1395-6 (May 17, 1958).

A "flop-in" method is described which employs a very short apparatus of three loops each 1/8 in. long separated by gaps of $3\frac{1}{2}$ in., all in a magnetic field of 25 gauss. It is being applied to measure the hyperfine structure of the ground level of Eu. R.W.Nicholls

539.14

7301. STABILITY OF PEAR-SHAPED NUCLEAR DEFORMATIONS. K.Lee and D.R.Inglis.
Phys. Rev., Vol. 108, No. 3, 774-8 (Nov. 1, 1957).

The possibility of stable pear-shaped deformations of nuclei is treated by a perturbation theory starting from the nucleon wave-functions of a spheroidal harmonic-oscillator potential, without spin–orbit coupling. The mixing of states of opposite parity tends to stabilize the deformation, and is opposed by the cohesiveness of nuclear matter that favours a spherical shape. The former is calculated explicitly for a number of cases and the latter is estimated by imposing a constant-volume condition in a simple manner closely analogous to a more familiar treatment of spheroidal deformations. In this approximation the mixing of the states is not quite enough to overcome the competing effect, so it merely "softens" the nucleus and does not stabilize a pear-shaped deformation. The most direct effect of spin–orbit coupling is to bring states of opposite parity closer together, tending to increase the mixing and make pear-shaped nuclei stable. A.

539.14

7302. TRANSITION ENERGIES AND NUCLEAR LEVELS IN Sm^{153}, Sm^{154}, Gd^{152}, and Gd^{154} AS DERIVED FROM THE SEPARATED ISOTOPES OF EUROPIUM.
J.M.Cork, M.K.Brice, R.G.Helmer and D.E.Sarason.
Phys. Rev., Vol. 107, No. 6, 1621-5 (Sept. 15, 1957).

Specimens of highly enriched Eu^{151} and Eu^{153} were irradiated in the Argonne CP-5 reactor and the product isotopes studied in both magnetic and scintillation spectrometers. Eu^{152} decays by electron emission to Gd^{152} and by K-capture to Sm^{152}. Eu^{154} emits beta particles leading to Gd^{154} but no evidence appeared for positron emission or K-capture leading to Sm^{154}. The many conversion-electron lines, together with coincidence data, allowed the evaluation of the gamma transitions and their arrangement in plausible nuclear level schemes. The beta spectra were resolved by the use of the double-focusing spectrometer. Each of the daughter nuclei is even-even in structure. A comparison is made of the observed lower energy transitions and the prediction from the "collective" model for rotational states. A.

539.14

7303. SEARCH FOR MONOPOLE PAIRS FROM THE SECOND EXCITED STATE OF C^{12}.
G.Goldring, Y.Wolfson and R.Wiener.
Phys. Rev., Vol. 107, No. 6, 1667-8 (Sept. 15, 1957).

A thorough search for monopole pairs from the second excited state in C^{12} is described. No pairs could be detected and it is concluded that the question of the angular momentum and parity of this state cannot yet be considered as solved. A.

539.14

7304. THE FIRST 0^+ LEVEL IN O^{16}. J.Pradal and M.Vénéroni.
C.R. Acad. Sci. (Paris), Vol. 246, No. 17, 2461-4 (April 28, 1958). In French.

The simple shell model cannot be made to account for the levels of O^{16}. Ferrell and Visscher (Abstr. 4579/1956, 1374/1957) have attempted to explain the first 0^+ level in O^{16} at 6.06 MeV by a linear combination of $(1s)^{-1}(2s)$ and $(1p)^{-1}(2p)$ configurations, but it is shown that in order to account for the excitation energy and lifetime of this level $(1p)^{-2}(2s)^2$, $(1p)^{-2}(1d)^2$, and $(1p)^{-2}(1s)(1\bar{d})$ configurations must be considered. A.E.I. Research Laboratory

539.14

7305. 9.51 MeV LEVEL IN N^{14}. D.M.Zipoy.
Phys. Rev., Vol. 110, No. 4, 995 (May 15, 1958).

The results reported in a previous paper (Abstr. 6545/1957) on a $C^{13}(p,p)C^{13}$ experiment were re-analysed. An assignment of $J = 2^-$ for the 9.51 MeV state is reported to give a better fit than the previous 3^- assignment. The new assignment is consistent with the radioactive-decay angular-distributions from the 9.51 MeV state.

L.L.Green

539.14

7306. ELECTRON-CAPTURE ENERGY AND LEVEL LIFETIME BY TEMPERATURE EFFECT IN Sm^{152} GAMMA-RAY RESONANCE.
P.B.Moon, G.G.Shute and B.S.Sood.
Phys. Rev. Letters, Vol. 1, No. 1, 21-2 (July 1, 1958).

Protons from the de-excitation of the 961 keV level in Sm^{152} were incident on a Sm scatterer, and the cross-section for resonant absorption was found to be 7×10^{-25} cm^2 with source and scatterer at room temperature. For source temperatures of 90^0 K and 1050^0 K the cross-sections were respectively 0.89 and 1.44 of the room-temperature value, showing that at room temperature much of the overlap of emission and absorption energy spectra is caused by thermal motion. When compared with computed curves, the experimental relation between cross-section and effective temperature shows that the total energy of the Eu^{152m} electron-capture transition is (925 ± 10) keV and suggests that the width of the level makes a rather small contribution to the resonance effect. The mean life of the level is then calculated to be 7×10^{-14} sec, about twice that obtained by Grodzins (Abstr. 5282/1958) on the assumption that the thermal contribution is small.

A.E.I. Research Laboratory

539.14

7307. SPACINGS OF NUCLEAR ENERGY LEVELS.
N.Rosenzweig.
Phys. Rev. Letters, Vol. 1, No. 1, 24-5 (July 1, 1958).

Matrix elements of real symmetric matrices are chosen at random from both a symmetric uniform distribution and a Gaussian distribution and the matrices are then diagonalized, to give the spacings. These turn out to be nearly the same in both cases, and to fit the experimental results well. G.E.Brown

539.14 : 539.166.83

7308. INTERNAL CONVERSION ELECTRON STUDY OF THE LOWER EXCITED LEVELS OF U^{235}.
E.F.Tret'yakov, G.I.Grishuk and L.L.Gol'din.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 811-19 (1958). In Russian.

The internal conversion electrons emitted by excited U^{235} nuclei after α-decay of Pu^{239} nuclei were investigated. Multipolarities of the transitions could be established and the spins and parities of the first six levels were determined by comparing the results with the theoretical internal conversion coefficients for the L_I and L_{II} shells. It is shown that the first five levels form a rotational band with K = 1/2. More precise values of the energies of the excited states were obtained. A.

539.14 : 539.163

ENERGY LEVELS OF Ce^{142}. See Abstr. 6231

539.14 : 539.163

LEVELS IN Dy^{161} See Abstr. 6233-4

539.14 : 539.163.2

ENERGY LEVELS OF Po^{212}. See Abstr. 6241

539.14 : 539.166

ENERGY LEVELS IN Fe^{56}. See Abstr. 6270

539.14 : 539.17

STUDY OF ENERGY LEVELS IN TIN ISOTOPES. See Abstr. 6314

539.14 : 539.17

$Ag^{108, 110}$ ENERGY LEVELS. See Abstr. 6328

539.14 : 539.17

ENERGY LEVELS OF Li, Be, B and N. See Abstr. 7362

539.14

7309. LIFETIME OF THE 0^+ EXCITED STATE IN Ge^{70}. H.W.Kendall.
Phys. Rev., Vol. 109, No. 3, 861-2 (Feb. 1, 1958).

It is found by a delayed-coincidence measurement that part of the 1.04 MeV gamma-radiation following the beta decay of Ga^{70} is delayed with a mean life of $\tau = (4.0 \pm 0.9) \times 10^{-9}$ sec. This lifetime is assigned to the 0^+ level in Ge^{70} at 1.2 MeV which feeds the 2^+ level by a 0.174 MeV E2 transition. The observed mean-life is about sixty times shorter than the Weisskopf single-particle estimate for the quadrupole transition. A.

539.14 : 539.163.1

HALF-LIVES OF EXCITED LEVELS IN Tm^{169} AND Bi^{208}. See Abstr. 6239-40

539.14

7310. THE DETERMINATION OF THE ENERGY OF THE 8.15 HOURS ISOMERIC STATE IN Ta^{180} USING A BETATRON. M.Gusakow and R.Basile.
C.R. Acad. Sci. (Paris), Vol. 246, No. 17, 2464-6 (April 28, 1958). In French.

The isomeric state in Ta^{180} was excited by using the $Ta^{181}(\gamma,n)Ta^{180}$ reaction and its excitation energy deduced from measurements of the neutron yield curve, and by direct energy measurements of the residual γ-ray emission from the irradiated targets, using a scintillation counter. A value 65 ± 25 keV was obtained. A.E.I. Research Laboratory

539.14

7311. SHORT-LIVED ISOMERS OF As^{75} AND As^{77}. A.W.Schardt.
Phys. Rev., Vol. 108, No. 2, 398-406 (Oct. 15, 1957).

Sources of Se^{75} and Ge^{77} were investigated by delayed-coincidence techniques for short-lived isomeric levels in the daughter nuclei As^{75} and As^{77}, respectively. The 0.305 MeV level of As^{75} has a half-life of 17 milliseconds and is depopulated by a 0.025 MeV M2 transition (90%) in competition with a 0.305 MeV E3 transition (10%). The 0.475 MeV level of As^{77} has a half-life of 116 microseconds and is depopulated by a 0.210 MeV M2 transition. An upper limit of 2% of the isomeric decays was placed on the intensity of any possible 0.475 MeV ground-state transition. In the beta decay of Ge^{77} to As^{77}, gamma-rays of the following energies were found to feed the metastable state: 0.153, 0.709, 1.08, and 1.50 MeV and probably also 0.92 and 1.96 MeV. The data obtained are incorporated in a recently proposed decay scheme of Ge^{77}. The previously discovered isomeric transition in As^{73}, as well as those in As^{75} and As^{77}, are probably all M2 transitions between 9/2+ and 5/2− levels, with transition probabilities of 0.9, 1, and 0.6%, respectively, of the shell-model single proton transition probability. A.

539.14 : 539.12

7312. SPINS AND PARITIES OF THE HYPERFRAGMENT H^4_Λ AND OF THE K-MESON. Chzhou Guan-Chzhao and M.I.Shirokov.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1072-3 (1957). In Russian. English translation in Soviet Physics — JETP (New York), Vol. 6, No. 4, 828-9 (April, 1958).

A summary is given of the angular correlations in the cascades

$$\pi^- + He^4 \rightarrow H^4_\Lambda + K, \; H^4_\Lambda \rightarrow He^4 + \pi, \; K \rightarrow \pi + \pi,$$

and

$$K^- + He^4 \rightarrow H^4_\Lambda + \pi, \; H^4_\Lambda \rightarrow He^4 + \pi$$

for several variants of spins and parities of H^4_Λ and of the K-meson. W.O.Lock

539.14 : 530.145

FUNDAMENTAL INTERACTIONS AND HYPERFRAGMENTS. See Abstr. 6625

539.14

7313. NUCLEAR ORIENTATION OF Mn^{54} IN ANTIFERROMAGNETIC SINGLE CRYSTALS. J.M.Daniels and M.A.R.LeBlanc.
Canad. J. Phys., Vol. 36, No. 5, 638-40 (May, 1958).

Nuclear alignment was produced in crystals of $MnCl_2.4H_2O$ and $MnBr_2.4H_2O$ by antiferromagnetic interactions. The crystals were cooled to below the Néel temperatures by adiabatic demagnetization and the anisotropy of γ-ray emission measured. D.J.Oliver

539.14 : 534.39

7314. ULTRASONIC SATURATION OF NUCLEAR MAGNETIC ENERGY LEVELS. W.G.Proctor and W.A.Robinson.
Arch. Sci. (Geneva), Vol. 9, No. 2, 167-70 (1956).

The spin—lattice relaxation of Na^{23} in NaCl was studied by exciting a crystal with ultrasonic waves at twice the Larmor frequency. The resulting changes in the populations of the spin levels were studied by using a pulse-resonance technique (Abstr. 4268/1950). The results were interpreted in terms of the interaction of the quadrupole moment of Na^{23} with the field gradients arising from the displacements of neighbouring Cl ions. To fit the experimental results one electron charge was associated with each Cl ion compared with a value of 100 calculated by van Kranendonk.

D.J.Oliver

539.14

7315. NUCLEAR POLARIZATION EFFECTS IN LIQUIDS AND GASES ADSORBED ON CHARCOALS.
E.Erb, J.L.Motchane and J.Uebersfeld.
C.R. Acad. Sci. (Paris), Vol. 246, No. 14, 2121-3 (April 9, 1958). In French.

Experiments are described which were performed in benzene and in other organic liquids and also in the gases NH_3 and H_2S adsorbed on charcoals. Dynamic polarization of the protons is produced by saturation of the electron resonance. The effect is produced only when the frequency is equal to the sum or difference of the nuclear and electronic resonance frequencies in the applied field, and its sign depends upon which of the two frequencies is used.

J.M.Baker

539.14

7316. A NEW METHOD OF DYNAMIC POLARIZATION OF ATOMIC SPINS IN SOLIDS. A.Abragam and W.G.Proctor.
C.R. Acad. Sci. (Paris), Vol. 246, No. 15, 2253-6 (April 14, 1958). In French.

A new method of dynamic polarization is proposed in a system in which two species of spins are coupled to one another. If the two species relax to the lattice at different rates, and the transition in which one spin of each species takes part is saturated, the species with the larger relaxation time acquires a polarization. The direction of this polarization depends upon which of the two transitions is saturated. The method is demonstrated by producing a polarization of the Li^6 nuclei in LiF. J.M.Baker

539.14

7317. A NEW METHOD OF POLARIZING NUCLEI IN FLUIDS ADSORBED ON CARBON. AN EXTENSION TO SOLIDS AND IN PARTICULAR TO IRRADIATED ORGANIC SUBSTANCES.
E.Erb, J.L.Motchane and J.Uebersfeld.
C.R. Acad. Sci. (Paris), Vol. 246, No. 21, 3050-2 (May 28, 1958). In French.

The method of increasing nuclear polarization previously described (see preceding abstract) has been extended to solids and in particular to organic substances irradiated by γ-rays. The nuclear polarization was increased by factors between 2 and 20. The method does not work when the paramagnetic resonance line is narrowed by exchange, although in these cases an increase in nuclear polarization is observed due to the Overhauser effect.

D.J.Oliver

539.14

7318. INDIRECT INTERACTIONS BETWEEN THE NUCLEAR SPINS N^{14} AND H^1 IN VERY LOW MAGNETIC FIELDS.
J.M.Rocard and P.J.Frank.
C.R. Acad. Sci. (Paris), Vol. 246, No. 17, 2466-9 (April 28, 1958). In French.

Proton resonances were observed at 8.4 kc/s in a number of inorganic and organic compounds containing nitrogen. The results are compared with spectra obtained at high fields and are discussed in terms of the theory of Gutowsky, McCall and Slichter (Abstr. 2617/1953). D.J.Oliver

539.14

7319. A NUCLEAR DOUBLE RESONANCE EXPERIMENT ON LIQUIDS IN MOTION. H.Benoit.
C.R. Acad. Sci. (Paris), Vol. 246, No. 21, 3053-5 (May 28, 1958). In French.

The liquid first flows through a wide bore tube in the magnet gap, in a time long compared with T_1, and then at higher velocity through a narrow tube placed along a diameter of the pole cap. Two coils were wound on the narrow tube, a receiver coil in the centre and a transmitter coil, off centre. The rate of flow and the r.f. field in the transmitter was adjusted to satisfy the conditions of rapid passage. Reversal of the nuclear polarization could be

detected as a change in the nuclear resonance signal observed at the transmitter. The method is valuable in the study of nuclear calorimetry. D.J.Oliver

539.14

7320. CORRECTIONS FOR NUCLEAR MAGNETIC RESONANCE MEASUREMENTS. D.W.McCall.
J. appl. Phys., Vol. 29, No. 4, 739-40 (April, 1958).

Considers the effects of finite modulation amplitude and the r.f. power level on nuclear resonance observations. Details are given for correcting observed values of second moments. D.J.Oliver

539.14

7321. A STUDY ON THE EFFECTS OF OFF-RESONANCE ON THE SPIN-ECHO SIGNALS. T.Ghose, S.K.Ghosh and D.K.Roy.
J. Phys. Soc. Japan, Vol. 12, No. 7, 816-19 (July, 1957).

A comprehensive study of the off-resonance effects on the different spin-echo signals obtained with three r.f.-pulses is made — both theoretically and experimentally. The main experimental bearing of this investigation lies in choosing the most suitable angles of the r.f. pulses for which the fluctuations in the current, driving the electromagnet, will cause minimum effect on the amplitudes of the echo signals used for relaxation time measurements. A.

539.14

7322. NUCLEAR MAGNETIC RESONANCE IN PARAMAGNETIC MnF_2. R.G.Shulman and V.Jaccarino.
Phys. Rev., Vol. 108, No. 5, 1219-31 (Dec. 1, 1957).

Nuclear magnetic resonances of F^{19} in crystals of paramagnetic MnF_2 were observed in the temperature region from 68° to 300°K. Shifts of the resonances from the predicted field, ω/γ, were as large as 8%. With the external magnetic field not in the ab plane, two separate resonances were observed corresponding to the two different fluorine positions in the unit cell. Both the shifts and the splittings were functions of magnetic field, temperature, and crystal orientation. As the temperature was increased, the line widths increased from 25 to 42 Oe. These observations were explained by postulating a small degree of covalency in the F^- bond to the paramagnetic Mn^{++} ion. Each bond includes 0.48 ± 0.02% fluorine 2s character. The contributions of the $2p_\sigma$ and $2p_\pi$ orbitals are discussed and the effects of the covalency upon the long-range order and the superexchange mechanism are considered. The lines disappeared at the Néel temperature, T_n, (68 ± 1°K) because the sudden increase in sublattice magnetization shifts them beyond the frequency range of the spectrometer. Attempts to observe the resonances at low temperatures are described. A.

539.14

7323. ELECTRON NUCLEAR DOUBLE RESONANCE OF NEODYMIUM. D.Halford, C.A.Hutchison, Jr and P.M.Llewellyn.
Phys. Rev., Vol. 110, No. 1, 284-6 (April 1, 1958).

A preliminary report is given of electron nuclear double resonance measurements on Nd^{3+} in $LaCl_3$ crystals. The second resonance frequency is frequency modulated, and the a.c. component of the microwave carrier at this modulation frequency is measured to detect the resonances, which have a width of 10^5 c/s. Precise values of the hyperfine structure parameters of the spin Hamiltonian are measured from which values of Q and g_N are estimated.

J.M.Baker

RADIOACTIVITY

539.16.08

7324. PREPARATION, MAINTENANCE, AND APPLICATION OF STANDARDS OF RADIOACTIVITY. W.B.Mann and H.H.Seliger.
Circ. Nat. Bur. Stand., No. 594, 47 pp. (1958).

The methods available for the preparation and maintenance of primary and secondary standards of radioactivity are reviewed, and the applications of such standards to problems in physics are discussed. A.

539.16.08

7325. RAPID ASSESSMENT OF SURFACE RADIOACTIVE CONTAMINATION. F.Bëhounek.
Nature (London), Vol. 181, 695-6 (March 8, 1958).

The use of an electrometer for measuring surface contamination is discussed and is shown to be capable of detecting β-contamination of density as low as 10^{-4} μc/cm². M.A.Grace

539.16.08 : 539.17

7326. NEUTRON, GAMMA MEASUREMENTS FOR IN-PILE POWER MONITORING. A.C.Lapsley.
Nucleonics, Vol. 16, No. 2, 106, 108, 110 (Feb., 1958).

A small ionization chamber with an active volume of 0.7 cm³ and sapphire insulators is used for γ-measurement at 10^9 r/hr. The neutron monitor is a thermocouple embedded in a small U—Al alloy button. R.D.Smith

539.16.08

7327. TRITIUM TRACING — A REDISCOVERY.
Nucleonics, Vol. 16, No. 3, 62-7 (March, 1958).

A review of a symposium held in New York in November 1957. Recent advances in the detection of weak β-particles and in the preparation of tritium-labelled compounds have increased the usefulness of tritium as a tracer. Labelling by the gas-exposure method is achieved by sealing 0.1-1 g of liquid or powdered material in contact with 2 cm³ (5 curies) of tritium for several days. The radiation damage is less than for recoil labelling. The liquid scintillating techniques described enable as little as 25 μμc of tritium to be detected. Gas counting is also sensitive and a full bibliography for these methods is included. R.D.Smith

539.16.08

7328. RADIOMETRIC METHODS FOR THE MEASUREMENT OF URANIUM AND THORIUM IN MINERALS. D.Prosperi and S.Sciuti.
Ricerca sci., Vol. 28, No. 2, 345-61 (Feb., 1958). In Italian.

Uranium or thorium contents in ores are estimated by making simultaneous measurements of β-activity and γ-activity above two different energy thresholds. Samples containing 0.05% uranium have been analysed with an accuracy of 5-6%. The uranium and thorium concentrations may be estimated separately, even when the activities of the two series are comparable, and the uranium family is not in equilibrium. P.Rothwell

539.163

7329. INVESTIGATIONS ON THE DISTRIBUTION OF THE DECOMPOSITION ELEMENTS OF A RADIOACTIVE FAMILY IN EQUILIBRIUM, IN NUCLEAR EMULSIONS. M.Bruno and G.Faraone.
Ricerca sci., Vol. 27, No. 1, 47-53 (Jan., 1957). In Italian.

The distribution of the characteristic α-tracks produced in nuclear emulsions by the different decomposition elements of the U^{238} family in radioactive equilibrium was examined; satisfactory agreement with calculated values was obtained. It was found that radon tends to diffuse towards the centre of the emulsion.

P.Rothwell

539.163 : 616.073.75

7330. RADIOGRAPHY WITH ARTIFICIAL RADIOACTIVE ISOTOPES. H.Herold.
Z. angew. Phys., Vol. 9, No. 7, 349-72 (July, 1957). In German.

Comparative tables show relevant physical properties of suitable radioactive isotopes. Relative merits of isotope sources for radiography and X-rays generated at similar energies are considered. Photographic blackening curves for Cs^{137} and Co^{60} sources are given and energy absorption in photographic emulsions treated theoretically. Physical processes underlying intensification with thin metal foils are discussed, and experimental results in terms of variation in photographic effect with atomic number of the foil are given for Cs^{137} and Co^{60}. Optimum thicknesses are derived. Experimental arrangements and results for image unsharpness for various foil thicknesses are given. Contrast in the radiograph is defined mathematically, and the effect of Pb fore-filters on contrast is measured. Cs^{137} radiographs of industrial subjects are shown. 44 references. D.V.Mabbs

539.163

7331. ISOTOPES OF BERKELIUM AND CALIFORNIUM PRODUCED BY NEUTRON IRRADIATION OF PLUTONIUM.
T.A.Eastwood, J.P.Butler, M.J.Cabell, H.G.Jackson, R.P.Schuman, F.M.Rourke and T.L.Collins.
Phys. Rev., Vol. 107, No. 6, 1635-8 (Sept. 15, 1957).

Samples of berkelium and californium were separated from neutron-irradiated plutonium and carefully purified. Pure Cf^{249} daughter was separated from the Bk^{249}. The californium sample and its curium decay products were mass-analysed. The berkelium fraction contained 314 ± 8 day Bk^{249} emitting 0.114 ± 0.015 MeV beta-particles and 5.417 ± 0.015 MeV and 5.03 ± 0.03 MeV alpha-particles. The α—β ratio was found to be (2.2 ± 0.3) × 10^{-5}. The californium sample contained: 360 ± 40 year Cf^{249} emitting 5.808 ± 0.010, 5.93 ± 0.02, and 6.20 ± 0.02 MeV alpha-particles; 10.9 ± 0.8 year Cf^{250} emitting 6.020 ± 0.010 MeV alpha-particles; 800 year Cf^{251}; 2.55 ± 0.15 year Cf^{252} emitting 6.112 ± 0.015 MeV alpha-particles; and 17 ± 1 day Cf^{253}. A.

539.163

7332. DECAY SCHEME OF Ba^{140}. A.N.Silant'ev.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 569-73 (1958). In Russian.

The γ-ray spectrum of Ba^{140} was measured with a scintillation

γ-spectrometer. The spectrum was treated by the method proposed by Maeder, Muller and Wintersteiger (Abstr. 5933/1954). The relative intensities of γ-rays with energies of 30, 160, 305, 430 and 537 keV were equal to 0.7, 0.18, 0.12, 0.18 and 1.0, respectively. Measurements of $\gamma-\gamma$ and $\beta-\gamma$ coincidences were carried out. On basis of the results obtained in the present paper and in previous investigations a decay scheme for Ba^{140} is proposed. A.

539.163

7333. STUDIES OF RARE EARTH ALPHA EMITTERS.
K.S.Toth and J.O.Rasmussen.
Phys. Rev., Vol. 109, No. 1, 121-5 (Jan. 1, 1958).

A series of bombardments using alpha particles from the Berkeley 60 in. cyclotron on rare earth oxides resulted in the discovery and mass assignment of two new alpha-emitting isotopes, Dy^{153} (5 hr) and Dy^{154} (13 hr). Mass assignments were made for two other alpha-emitters, Dy^{152} (2.3 hr) and Tb^{151} (19 hr). A new 10 hr electron-capture isotope was identified as Dy^{155}. Evidence is also presented for the discovery of another isotope, Dy^{149} (8 min), which was produced by a N^{14} ion bombardment on praseodymium. A.

539.163.1

7334. THE HALF-LIVES OF SOME SHORT-LIVED ISOTOPES.
M.V.Mihailović and B.Povh.
Nuclear Phys., Vol. 7, No. 3, 296 (June [3], 1958).

The following half-life values were obtained for isotopes prepared by (γ,n) reactions with a 31 MeV betatron:

Mg^{23}	12.1(1 ± 0.008) sec,	Al^{26}	6.74(1 ± 0.004) sec,
Si^{27}	4.14(1 ± 0.007) sec,	S^{31}	2.72(1 ± 0.006) sec,
Cl^{34m}	1.61(1 ± 0.007) sec,	K^{38m}	0.97(1 ± 0.007) sec,

Ca^{39} 0.86(1 ± 0.006) sec.

M.A.Grace

539.163.2 : 539.14

7335. AN INVESTIGATION OF THE DECAY SCHEME OF Ta^{182} BY MEANS OF A COINCIDENCE SCINTILLATION SPECTROMETER.
P.O.Fröman and H.Ryde.
Ark. Fys., Vol. 12, Paper 18, 399-413 (1957).

The level scheme of W^{182} proposed by Murray et al. (Abstr. 4027/1955) and refined by Alaga et al. (Abstr. 9869/1955) is in its essential features confirmed by means of coincidence experiments. Gamma-ray intensities differing somewhat from those by Murray et al. are also obtained. A.

539.163.2

7336. ON THE DECAY $Nd^{140} \rightarrow Pr^{140} \rightarrow Ce^{140}$.
K.Ya.Gromov, B.S.Dzhelepov, A.G.Dmitriev and B.K.Preobrazhenskiĭ.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 153-7 (1958). In Russian.

The yield of K-Auger electrons, e_K/K_Σ, was determined, where e_K is the number of K-Auger electrons and K_Σ is the number of K-captures coming from 1 decay of Nd^{140} and Pr^{140}, found in equilibrium, and where $e_K/K_\Sigma = (e_K/\beta^+).(\beta^+/K)$. If β^+/K_Σ is assumed from other experiments, then $e_K/K_\Sigma = 3.6\%$ (±30%) instead of the expected 10%, while if e_K/K_Σ is assumed to be 10% then $\beta^+/K_\Sigma = 0.55$, which agrees (within the instrumental errors of 30-40%) with the expected value for the chain $Nd^{140} \rightarrow Pr^{140} \rightarrow Ce^{140}$. W.O.Lock

539.163.2

7337. RADIOACTIVE DECAY OF Eu^{154}.
S.K.Bhattacharjee, S.Raman and S.K.Mitra.
Proc. Indian Acad. Sci. A, Vol. 47, No. 5, 295-309 (May, 1958).

The radioactive decay of Eu^{154} ($t_{1/2}$ = 16 years), obtained from thermal neutron irradiation of 95% enriched Eu^{153}, was studied by using the Seigbahn-Slätis intermediate image spectrometer, a thin lens magnetic spectrometer and a coincidence scintillation spectrometer. The following gamma-rays (energies in keV) were identified as belonging to this isotope: 123, 248, 585, 717, 759, 875, 998, 1007, 1285, 1600. Beta end-points of Eu^{154} were measured at 275 (20%), 590 (45%), 890 (23%) and 1860 (12%). The K-conversion coefficient of the 123 keV gamma-ray was experimentally determined to be ≅ 0.5. On the basis of gamma–gamma and beta–gamma coincidences, the decay scheme of Eu^{154} was deduced: the resulting level-structure of Gd^{154} conforms well with the predictions of the unified nuclear model. A.

539.164.2 : 539.14

7338. DEPENDENCE OF THE α-DECAY RATE ON ENERGY OF ROTATIONAL LEVELS. L.L.Gol'din.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 643-5 (1958). In Russian.

In α-decay of spin 1/2 nuclei to rotational levels with K = 1/2 it is possible to separate the dependence of the α-decay probability on energy from the dependence on the angular momentum carried off by the α-particle. An analysis is carried out for Pu^{239} shows that the energy dependence of the α-decay rate for levels belonging to the same rotational band obeys the same formula as does the rate of α-decay to the ground levels of even-even nuclei. A

539.165 : 539.166

7339. BETA–GAMMA CORRELATIONS FROM POLARIZED MANGANESE 52.
E.Ambler, R.W.Hayward, D.D.Hoppes and R.P.Hudson.
Phys. Rev., Vol. 110, No. 3, 787-9 (May 1, 1958).

Measurements were made on polarized Mn^{52} of the β-asymmetry and of the $\beta-\gamma$ angular correlation. The results are consistent with time-reversal invariance for the β-transition and show it to be a mixture of Fermi and Gamow–Teller decay modes. M.A.Grace

539.165

7340. THE (ϵ/β^+) RATIO IN THE DECAY OF ^{48}V AND THE FLUORESCENT YIELD IN Ti. H.L.Hagedoorn and J.Konijn.
Physica, Vol. 23, No. 11, 1069-72 (Nov., 1957).

Scintillation and proportional counters in coincidence were used to measure the ϵ/β^+ ratio as 0.74 ± 0.02 which yields a value of −0.01 ± 0.01 for the Fierz interference term in the β-transition. A value of 0.18 ± 0.01 was found for the fluorescence yield in Ti. M.A.Grace

539.165 : 539.166

7341. HIGHER-ORDER EFFECTS IN THE ALLOWED BETA DECAY OF F^{20}. F.Boehm, V.Soergel and B.Stech.
Phys. Rev. Letters, Vol. 1, No. 2, 77-9 (July 15, 1958).

Gell-Mann (Abstr. 507/1958) has suggested that the vector interaction in beta decay might be analogous to the electromagnetic interaction of nucleons, and that there would then be a significant and calculable term corresponding to the anomalous magnetic moment. It is pointed out here that such a term would give rise to a small anisotropy in the beta–gamma angular correlation for an allowed transition. An experiment was performed on F^{20}, accepting electrons above 4.5 MeV. The anisotropy coefficient was found to be (0.94 ± 0.28)% compared with a prediction on Gell-Mann's assumption (neglecting orbital contributions to the "weak magnetism") of 0.45%. J.C.Taylor

539.165 : 539.166

7342. NON-CONSERVATION OF PARITY IN K-CAPTURE.
M.Bernardini, P.Brovetto, S.Debenedetti and S.Ferroni.
Nuovo Cimento, Vol. 7, No. 3, 419-21 (Feb. 1, 1958).

The internal bremsstrahlung accompanying K-capture in Ge^{71} was shown to be circularly polarized (R.C.P.). A 2.5 ± 0.5% change in scattered intensity was observed on reversal of the magnetic field in the back-scattering Compton polarimeter and its sign is in accord with the observation that for negatrons σ.p is negative. M.A.Grace

539.165.2

7343. CIRCULAR POLARIZATION OF INTERNAL BREMSSTRAHLUNG. A.Pytte.
Phys. Rev., Vol. 107, No. 6, 1681-5 (Sept. 15, 1957).

A calculation is made of the circular polarization of the internal bremsstrahlung in allowed β-decay with the most general β-interaction. The polarization is found to rise from zero at the low-energy end of the spectrum to a maximum value at the high-energy end. This maximum value depends critically on the relative magnitudes of the coupling constants in the β-interaction. With the two-component neutrino theory and only the scalar and tensor interactions present, the polarization is complete at the high-energy end of the spectrum. Plots were made, with this β-coupling, of the Born approximation result for the circular polarization as a function of photon energy for S^{35} and P^{32}. The effects of the nuclear Coulomb field on the γ-ray spectrum and polarization are discussed. A.

539.165.2

7344. ASYMPTOTIC SELECTION RULES FOR BETA-DECAY OF DEFORMED NUCLEI. M.E.Voĭkhanskiĭ.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1054-6 (1957). In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 6, No. 4, 812-13 (April, 1958).

Generalizing the work of Alaga (Abstr. 1531/1956), these selection rules are tabulated for different types of interaction and for transitions of any order of forbiddenness. J.C.Taylor

539.165.2

7345. ELECTRON POLARIZATION IN β-DECAY.
A.I.Alikhanov, G.P.Eliseev, V.A.Lyubimov and B.V.Érshler.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 785-99 (1958). In Russian.

In connection with parity conservation some experiments were carried out for detection of longitudinal polarization of electrons

emitted in β-decay. It is found that the β-electrons are emitted with a spin opposite to the direction of motion. The degree of longitudinal polarization is consistent with the value $-v/c$. A.
539.166

7346. GAMMA–GAMMA ANGULAR CORRELATIONS IN Ca^{43}, Hg^{200} AND Pb^{206}. T.Lindqvist.
Ark. Fys., Vol. 12, Paper 22, 495-517 (1957).

An automatic apparatus for angular correlation measurements is described. The corrections for counter solid angle are experimentally determined. Gamma–gamma angular correlation measurements determine the spins of two excited levels in Ca^{43} and three excited levels in Hg^{200}. In Pb^{206} spins of five excited levels, given by Alburger and Pryce, are verified. Triple correlations are used in two cases. A.
539.166

7347. ANGULAR CORRELATION MEASUREMENTS ON Cu^{65}.
B.Hartmann and I.Asplund.
Ark. Fys., Vol. 13, Paper 27, 339-45 (1958).

The angular correlation of the two cascaded γ-rays of energies 0.38 MeV and 1.11 MeV in Cu^{65} was studied with scintillation spectrometers. The coefficients of the Legendre expansion $W(\theta) = 1 + A_2P_2 + A_4P_4$ of the coincidence distribution function were determined: $A_2 = 0.24 \pm 0.01$, $A_4 = -0.01 \pm 0.01$. The anisotropy is $A = [W(\pi) - W(\pi/2)]/W(\pi/2) = 0.41 \pm 0.02$. The most probable spin sequence of the Cu^{65} states is shown to be

$$7/2- \xrightarrow[M1 + (E2)]{0.38} 7/2- \xrightarrow[E2]{1.11} 3/2-$$

with 1% E2 in the 0.38 MeV transition. A.
539.166 : 539.165

7348. SOME FEATURES OF THE DECAY OF Au^{198} TO Hg^{198}.
G.Bäckström and O.Bergman.
Ark. Fys., Vol. 13, Paper 31, 393-7 (1958).

Hg^{198} is found to emit gamma-rays of energies 0.675 75 MeV and 1.0875 MeV in decaying from its second excited state. A splitting of this state, which has recently been reported, is not observed. The β-branching to a state at 1.000 MeV, observed in the decay of Tl^{198m}, is shown to be weaker than theoretically expected. The results are discussed. A.
539.166

7349. GAMMA-RADIATION FROM DISINTEGRATION OF I^{128}_{53}.
H.E.Bosch, H.Munczek and R.Radicella.
Ciencia (Mexico), Vol. 12, No. 7, 311-16 (July, 1958). In Spanish.

The γ-radiation from I^{128} was studied by means of a single-channel analyser and with two different size crystals. The Compton background was substracted for the assignment of photopeak energies, periods and relative intensities. A coincidence circuit was used and $\gamma-\gamma$ coincidences were observed. A.
539.166

7350. RADIONUCLIDES ARRANGED BY GAMMA-RAY ENERGY.
G.W.Smith and D.R.Farmelo.
Nucleonics, Vol. 16, No. 2, 80-1 (Feb., 1958).

Nucleonics data sheet No. 22. Includes nuclides derived from (n,γ) reactions and fission products of $> \frac{1}{2}\%$ yield having half-lives longer than a few minutes. Gamma-rays which account for less than 10% of the total activity of any nuclide are omitted.
R.D.Smith
539.166

7351. INHIBITION OF M1 γ TRANSITIONS WITH $\Delta T = 0$ IN SELF-CONJUGATE NUCLEI. G.Morpurgo.
Phys. Rev., Vol. 110, No. 3, 721-5 (May 1, 1958).

It is shown that the strengths of M1 γ transitions with no change of isotopic spin in self-conjugate nuclei may be expected to be smaller by a factor 100 than the normal M1 strengths; the reason is that the matrix element for the particular M1 transitions mentioned above is considerably reduced owing to an almost complete cancellation of the protonic, neutronic, and orbital magnetic moments. A number of experimental confirmations of the above rule are discussed. A.
539.166

7352. GAMMA-TRANSITIONS IN SELF-CONJUGATE NUCLEI.
E.K.Warburton.
Phys. Rev. Letters, Vol. 1, No. 2, 68 (July 15, 1958).

Gamma transition strengths in self-conjugate nuclei are studied, and it is shown that the inhibiting factor of about 100 calculated by Morpurgo (preceding abstract) for M1 transitions is expected to apply to all magnetic transitions. It is noted that the collective contribution of the core to E2 and E3 transitions with $\Delta T = 1$ in self-conjugate nuclei is negligible, if the method of Elliot and Flowers (Abstr. 717/1958) is generally valid.
A.E.I. Research Laboratory
539.166

7353. A RE-MEASUREMENT OF TWO GAMMA RAY LINES FROM ^{152}Eu AND ^{154}Eu. B.Andersson.
Proc. Phys. Soc., Vol. 72, Pt 1, 148 (July, 1958).

The energies of the lines were determined to an accuracy of about 1 part in 3000. J.M.Cassels
539.166.07

7354. APPLICATIONS OF A MULTI-CHANNEL GONIOMETER.
T.Lindqvist and E.Karlsson.
Ark. Fys., Vol. 12, Paper 23, 519-36 (1957).

A multi-channel goniometer (MCG) for gamma–gamma angular correlation measurements is described. The apparatus has four channels. Various methods of measurement and a complete treatment of data are given. The MCG was carefully tested with well known correlations (Bi^{207}, Hf^{181} and Co^{60}). As applications the angular correlations of gamma cascades from Ba^{131} and Nd^{147} were investigated. Both cases involve l-forbidden magnetic dipole transitions. From the mixing ratios determined in the correlation experiments it is possible to estimate the strength of forbiddenness. An upper limit of the g-factor of the 92 keV level in Pm^{147} is determined by studying the influence of a magnetic field on the angular correlation. A.
539.166.07

7355. A DOUBLE γ-RAY SPECTROMETER FOR COINCIDENCE COUNTING OF POSITRONS. J.W.Weale.
J. sci. Instrum., Vol. 35, No. 8, 297-9 (Aug., 1958).

The spectrometer was developed specifically for the counting of positrons in the presence of other β- and γ-ray emitters. It has a discrimination factor about a hundred times better than a simple γ-ray spectrometer. A method of efficiency calibration including correction for the effect of positron-γ-ray coincidences is described. A.
539.166.08

7356. THE USE OF ELECTRICALLY STIMULATED CURRENTS IN CADMIUM SULPHIDE MONOCRYSTALS FOR MEASURING DOSES OF γ-RADIATION. M.Borisov, S.Kŷnev, I.Georgieva and E.Vateva.
C.R. Acad. Bulg. Sci., Vol. 11, No. 1, 25-8 (Jan.-Feb., 1958).
In Russian.

The instantaneous current that flows when a relatively small potential ($\sim$ 20 V) is applied to a suitably prepared CdS crystal that was exposed to γ-radiation, can, it is claimed, be made the basis of a simple and extremely sensitive dose-measuring apparatus. Using selected crystals and a galvanometer reading to 10^{-8} A, a sensitivity in the milliroentgen range was readily obtained.
C.H.L.Goodman
539.166.08

7357. GAMMA-DOSE ENHANCEMENT FROM NEUTRON CAPTURE IN Cd. D.E.Kline and F.J.Remick.
Nucleonics, Vol. 16, No. 3, 97-101 (March, 1958).

The gamma-dose rate in a Victoreen condenser R-meter covered with 0.24 cm of polythene was measured, with and without a Cd shield, near to the thermal column of a swimming pool reactor. The Cd caused an increase of the gamma flux by a factor of 7 in the highest neutron flux. R.D.Smith
539.166.83 : 539.165

7358. NATURAL WIDTH OF INTERNAL CONVERSION LINES OF A PRECIPITATE OF RADIOACTIVE THORIUM.
G.D.Latŷshev, A.G.Sergeev, É.M.Krisyuk, L.A.Ostretsov, Yu.S.Egorov and N.M.Shirshov.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 20, No. 3, 354-62 (1956).
In Russian.

The widths are investigated in great detail using a magnetic spectrometer. The F-line, which comes from conversion of a γ-ray by a K-electron in Bi^{212} (ThC) is found to have a natural width of 67 $\pm$ 5 eV. The G-line, also from the K-electron in Bi, and the H- and L-lines, from conversion by K-electrons in Pb^{208} (ThD), have the same widths, within the limits of error. G.E.Brown
539.166.83 : 539.165

7359. INTERNAL CONVERSION ELECTRON SPECTRUM OF RADIOTHORIUM. II. A.I.Zhernovoĭ, É.M.Krisyuk, G.D.Latŷshev, A.S.Remennyĭ, A.G.Sergeev and V.I.Fadeev.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 682-9 (1957). In Russian.
English translation in: Soviet Physics — JETP (New York), Vol. 5, No. 4, 563-9 (Nov., 1957).

The internal conversion electron spectrum of a sample of ThC'' (Tl^{208}) was investigated in the $H\rho$ range from 500 to 1380 gauss cm. The energies and relative intensities of the conversion lines were determined. It is shown that spectrometers can be calibrated with an accuracy of 5×10^{-4} through the use of Auger electrons.
A.

NUCLEAR REACTIONS

539.17

7360. NUCLEAR REACTIONS IN DIRECT INTERACTION.
O.Hittmair.
Acta phys. Austriaca, Vol. 12, No. 1, 84-90 (1958). In German.

The possibility of direct nuclear reactions, in which no compound nucleus is formed, is considered. Appreciable direct interactions are found for very high energies of the incident particle because of the transparency of the nucleus and for medium and low energies in surface reactions where the nuclear potential is not as strong. The differential cross-section for the direct process is formulated and obtained with the help of the impulse approximation in both cases. The angular distribution shows a characteristic dependence on the initial and final states of the nucleus and may be used to gain valuable information regarding their spins and parities. P.K.Kabir

539.17

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also under "Cosmic rays". Decimal classification 537.591.8

539.17

7361. INVESTIGATION OF LIGHT NUCLEI WITH (p,γ) REACTIONS. C.van der Leun.
University of Utrecht Dissertation (1958) 100 pp.

Measurements of the proton resonance energies for radiative capture, the γ-ray yield, γ-ray spectra, angular distributions and $\gamma-\gamma$ coincidences using separated Mg^{25}, Mg^{26}, Si^{29}, S^{32} and S^{33} targets and proton energies from 200 to 800 keV are presented together with their analysis to yield nuclear level parameters. A literature survey of all (p,γ) information in the mass region $22 < A < 35$ giving information on proton and radiative widths, and a calculation of the Coulomb nuclear radius are included. Descriptions of apparatus and experimental procedures are also given.
A.E.I. Research Laboratory

539.17 : 539.14

7362. INELASTIC SCATTERING OF 185 MeV PROTONS ON LITHIUM, BERYLLIUM, BORON AND NITROGEN.
H.Tyrén and T.A.J.Maris.
Nuclear Phys., Vol. 6, No. 1, 82-6 (March [2], 1958).

Further measurements are reported on the energy spectra and angular distribution of protons inelastically scattered on light nuclei using incident proton beams of energy about 182 MeV. The apparatus was described previously (Abstr. 6552/1957, 5341/1958). Natural lithium, beryllium, boron and nitrogen targets were irradiated. Several peaks were observed in the spectra from which it was possible to deduce information on the level structures involved.
A.E.I. Research Laboratory

539.17

7363. THE ANGULAR DISTRIBUTIONS OF THE LONG-RANGE ALPHA-PARTICLES FROM THE REACTION $F^{19}(p,\alpha_0)O^{16}$.
A.Isoya, H.Ohmura and T.Momota.
Nuclear Phys., Vol. 7, No. 2, 116-25 (June [2], 1958).

The angular distributions of the long-range alpha-particles from the reaction F^{19} + p, leading to the ground state of the residual nucleus O^{16}, were measured. The energies of protons covered a range from 630 keV to 1460 keV, and measurements were made in steps of 5 to 10 keV with a proton energy spread of 0.2%. Coefficients in the Legendre polynomial expansion of the angular distribution function were traced in this range. A.

539.17 : 539.14

7364. ANALYSIS OF THE YIELD CURVES AND THE ANGULAR DISTRIBUTIONS OF THE REACTIONS $F^{19}(p,\alpha_0)O^{16}$ AND $F^{19}(p,\alpha_\pi)O^{16}$. A.Isoya.
Nuclear Phys., Vol. 7, No. 2, 126-45 (June [2], 1958).

By analysis of the angular distributions of α-particles from the reactions $F^{19}(p,\alpha)O^{16}$ leading to the ground state and first excited state of O^{16} (α_0 and α_π respectively), virtual levels of the nucleus Ne^{20} with spin and parity (even)$^+$ and (odd)$^-$ were investigated. Legendre polynomial expansions were adjusted to the data and the coefficients determined over the energy interval from 650 keV to 1500 keV. These results were then interpreted in terms of the resonance parameters of the compound levels presumed, and the following J-values were assigned: J = 2 levels at 731, 778, 843, 1115 and 1356 keV, a J = 1 level at 1250 keV and a J = 0 level at 1160 keV. Background yields are probably due to a few broad levels of J = 0 and 1. For the α_0-channel, vector diagrams of five elements of the collision matrix concerned, which correspond to two values of entrance channel spin and three values of relative orbital angular momentum, were drawn, which reproduce almost all details of observed excitation functions. This procedure gives information about the relative signs of the reduced width amplitudes of the virtual levels. This sign seems to be independent of the entrance channel spin in spite of large fluctuations of the relative yield in both channels from level to level. Yields of α_0, α_π and protons from each resonance are compared and the reduced widths of levels of Ne^{20} are estimated. A.

539.17

7365. INELASTIC SCATTERING FROM AND (p,α) REACTIONS OF THE COPPER ISOTOPES.
M.Mazari, W.W.Buechner and R.P.de Figueiredo.
Phys. Rev., Vol. 108, No. 2, 373-7 (Oct. 15, 1957).

The excited states of Cu^{63}, Cu^{65}, Ni^{60}, and Ni^{62} were investigated through studies of the proton and alpha-particle groups emitted from isotopically enriched targets of copper. A 6.51 MeV proton beam from an electrostatic accelerator and a high-resolution magnetic spectrograph were used in the investigation. The regions of excitation studied were from the ground state to 3.5 MeV in the case of Cu^{63}, 3.1 MeV for Cu^{65}, 3.7 MeV for Ni^{60}, and 3.5 MeV for Ni^{62}. The Q-value for the $Cu^{63}(p,\alpha)Ni^{60}$ reaction is 3.753 ± 0.008 MeV and for the $Cu^{65}(p,\alpha)Ni^{62}$ reaction, 4.341 ± 0.008 MeV. A.

539.17

7366. INELASTIC SCATTERING OF 4 MeV PROTONS AND DEUTERONS FROM SEPARATED ISOTOPES OF Dy^{161}, Dy^{163}, Yb^{171}, AND Yb^{173}. B.Elbek, K.O.Nielsen and M.C.Olesen.
Phys. Rev., Vol. 108, No. 2, 406-10 (Oct. 15, 1957).

The scattering was measured at energies around 4 MeV in a heavy-particle spectrometer at a scattering angle of 145°. Isotopically pure targets were prepared in an electromagnetic isotope separator. Inelastic groups corresponding to the two lowest rotational states were observed in Dy^{161} at 44 keV and 102 keV, in Dy^{163} at 74 keV and 170 keV, in Yb^{171} at 67 keV and 76 keV, and in Yb^{173} at 78 keV and 181 keV. The reduced electric quadrupole transition probabilities for these levels were determined. A.

539.17

7367. SCATTERING OF PROTONS BY HELIUM BETWEEN 11.4 MeV and 18 MeV. K.W.Brockman.
Phys. Rev., Vol. 108, No. 4, 1000-6 (Nov. 15, 1957).

Measurements of the elastic differential cross-section for the scattering of protons by helium were made at 12 energies between 11.4 and 18 MeV. Ten scattering angles were used spaced at 15° intervals from 30° to 165° in the laboratory system; however, not all the angles were used at each energy. Standard gas-scattering techniques were employed. Scattered particles were detected by a scintillation counter and recorded on a 20-channel pulse-height analyser. At nine of the scattering angles (165° excluded), smoothed curves of the cross-section v. energy were plotted and values taken from these curves were analysed in terms of S- and P-wave phase shifts. Two separate sets of S and P phase shifts intersecting at about 13 MeV were found. Least-squares fits are given for the solutions which are a continuation of phase-shift analyses at lower energies. Attempts to include D waves in the fits failed. There is evidence that D phase shifts remain less than about 8° up to 16 MeV; however, at 18 MeV it appears that some D wave may be required. Rough agreement with current polarization experiments is cited. A.

539.17

7368. FURTHER INVESTIGATION OF N^{15} + p REACTIONS.
F.B.Hagedorn and J.B.Marion.
Phys. Rev., Vol. 108, No. 4, 1015-19 (Nov. 15, 1957).

Excitation functions at nine angles for the reaction of $N^{15}(p,\alpha_0)C^{12}$ are reported for incident proton energies from 0.9 to 1.3 MeV. At a laboratory angle of 140° the excitation function is extended to 2.9 MeV. In addition to previously reported resonances near 1.03 and 1.21 MeV, corresponding to O^{16} states at 13.08 and 13.24 MeV, an anomalous behaviour is observed near 1.87 MeV. Additional evidence for such behaviour near this energy was obtained from the $N^{15}(p,\alpha_1\gamma)C^{12}$ reaction. The qualititative features of the $N^{15}(p,\alpha_0)C^{12}$ data are shown to be consistent with the assignments J = 1$^-$, J = 1$^-$, and J = 3$^-$ for the 0.34, 1.03, and 1.21 MeV resonances respectively. Fitting Breit–Wigner curves to the measured excitation function of $N^{15}(p,\alpha_1\gamma)C^{12}$ near 1.64 and 1.98 MeV has yielded E_R = 1.640 ± 0.003 MeV (Γ = 68 ± 3 keV) and E_R = 1.979 ± 0.003 MeV (Γ = 23 ± 2 keV) for these previously reported resonances (O^{16} states at 13.65 and 13.97 MeV). It is shown that $\Gamma_p/\Gamma \ll 1$ for the resonance at 1.98 MeV. A.

539.17

7369. TIME-REVERSAL INVARIANCE IN NUCLEAR SCATTERING. P.Hillman, A.Johansson and G.Tibell.
Phys. Rev., Vol. 110, No. 5, 1218-19 (June 1, 1958).

The invariance was tested by checking the equality of polarization and asymmetry in the scattering of protons by nuclei and by hydrogen. No inequalities were observed. J.M.Cassels

539.17

7370. ELASTIC SCATTERING OF ANTIPROTONS FROM COMPLEX NUCLEI. G.Goldhaber and J.Sandweiss.
Phys. Rev., Vol. 110, No. 6, 1476-8 (June 15, 1958).

In 16 metres of track length in nuclear emulsions of antiprotons between 50 and 200 MeV energy 111 scattering with projected angle $> 2^\circ$ were found showing no measurable energy loss and no recoil. From the angular distribution it seems likely that all the elastic scattering can be fitted within the accuracy of the experiments by a model in which the elastic scattering occurs as a consequence of the strong nuclear absorption of antiprotons. 55 antiprotons had two elastic scatterings in the same track. In 33 cases these are in the same direction, in 22 they are opposite. No definite conclusion can be drawn about polarization effects. S.J.Goldsack

539.17 : 539.14

7371. INVESTIGATION OF MULTIPLE SCATTERING OF PROTONS. F.R.Arutyunyan.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 800-6 (1958). In Russian.

Multiple scattering of protons with energies from 90 to 200 MeV and with energies from 40 to 60 MeV was investigated respectively in lead and copper plates of various thicknesses. The experimental data are compared with the multiple Coulomb scattering curves for a point and extended nucleus. A consequence of diffraction scattering is that the experimental results do not agree with the theoretical values for a finite-sized nucleus and exceed them. The effect of nuclear scattering depends on the relation between the angle $\theta = \lambda/R$ and the mean square value of the angle of multiple Coulomb scattering. The integral cross-section for nuclear scattering of protons $\sigma = (0.0755 \pm 0.0375)\, \sigma_{geom}$ was obtained in the angle region in which Coulomb scattering is small compared with nuclear scattering. This value is in good agreement with the optical model of an "absolutely black" nucleus. A.

539.17

7372. STUDY OF THE REACTIONS $_6C^{12}(d,p)_6C^{13}$ AND $_8O^{16}(d,p)_8O^{17}$. F.Alba A., T.A.Brody, A.Fernández, M.Mazari, V.Serment and M.Vásquez B.
An. Inst. Fís., Vol. 1, 1-17 (1955). In Spanish.

539.17

7373. EXCITATION CURVES OF THE $N^{14}(d,n)O^{15}$ REACTION. S.Morita.
J. Phys. Soc. Japan, Vol. 13, No. 2, 126-8 (Feb., 1958).

The curves were measured, with a thin plastic scintillator and a pulse-height analyser in the energy, range of deuterons from 1.00 to 2.15 MeV. Three excitation functions were obtained at the directions of 0°, 90° and 165° (laboratory system) with respect to the incident deuterons. The curves obtained at 0° and 165° show remarkable peaks at the deuteron energies of 1.6 and 1.9 MeV, respectively, while the curve obtained at 90° is nearly flat. A.

539.17

7374. SINGLE-PARTICLE INTERPRETATION OF PROTON SPECTRA FROM (d,p) REACTIONS.
J.P.Schiffer, L.L.Lee,Jr, J.L.Yntema and B.Zeidman.
Phys. Rev., Vol. 110, No. 5, 1216 (June 1, 1958).

A gross structure similar to the "anomalous" inelastic scattering of protons found by Cohen (Abstr. 4714/1957) is obtained for the proton spectrum from (d,p) reactions on different elements such as Cr, Mn, Fe. The spectrum is intentionally measured with a poor resolution. The high-energy part exhibits (mainly in the case of a bombarding deuteron energy of 21 MeV) three peaks corresponding to final excitations of 0, 2.5, and 5 MeV. Theoretical considerations are proposed to connect these results with the previous studies of the neutron strength function γ^2/D for neutrons of positive energy, the idea being that, in Butler's theory of stripping, the amplitude is proportional to the neutron reduced width in the final state. J.Lascoux

539.17

7375. NUCLEON POLARIZATION IN STRIPPING REACTIONS. H.A.Weidenmüller.
Z. Phys., Vol. 150, No. 4, 389-406 (1958). In German.

Starting from the usual matrix-element for stripping reactions, the influence of the tensor force in the deuteron and the deviation from pure j—j coupling for the captured nucleon on the polarization of the liberated nucleon is investigated. The polarization depends on the deuteron-target nucleus phase-shifts and also on the phase-shifts for scattering of the freed nucleon by the final nucleus; this is investigated numerically. For small angles, the sign of the polarization is positive or negative according as the captured nucleon, with orbital angular momentum l, couples to $j = l - \frac{1}{2}$ or to $j = l + \frac{1}{2}$. P.K.Kabir

539.17

7376. CONTRIBUTION TO THE THEORY OF STRIPPING AT HIGH ENERGIES. A.I.Akhiezer and A.G.Sitenko.
Zh. éksper. teor. Fiz., Vol. 33, No. 4 (10), 1040-2 (1957).
In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 6, No. 4, 799-801 (April, 1958).

The cross-section for the stripping reaction has previously been calculated by Serber with the approximation that the nuclear radius is very much greater than the deuteron radius. In the present work the stripping cross-section is calculated without using this approximation. A.E.I. Research Laboratory

539.17

7377. REACTIONS $Li^7(\alpha,n)B^{10}$, $Li^7(\alpha,\alpha')Li^{7*}$, AND $B^{10}(n,\alpha)Li^7$. H.Bichsel and T.W.Bonner.
Phys. Rev., Vol. 108, No. 4, 1025-7 (Nov. 15, 1957).

The nuclear reactions $Li^7(\alpha,n)B^{10}$ and $Li^7(\alpha,\alpha')Li^{7*}$ were studied for monoenergetic α particles from a Van de Graaff accelerator. The threshold in the (α,n) reaction was measured to be 4.379 MeV, which gives a Q value of −2.788 MeV. Resonances in the yield of 0.477 MeV γ-radiation were observed at α-particle energies of 1.91, 2.49, 3.06, 3.6, 4.39, 4.6 and 5.0 MeV. The inverse reaction $B^{10}(n,\alpha)Li^7$ was also studied by using monoenergetic neutrons with energies between 0.020 and 4.80 MeV. Resonances were observed at neutron energies of 0.53, 1.86, 2.8 and 4.1 MeV. Excited states in B^{11} from these experiments are indicated at 9.88, 10.25, 10.62, 10.97, 11.46, 11.6, 11.9, 13.2, 14.0 and 15.2 MeV. A.

539.17

7378. EXPERIMENTAL OBSERVATION OF DOUBLE COULOMB EXCITATION. J.O.Newton and F.S.Stephens.
Phys. Rev. Letters, Vol. 1, No. 2, 63-5 (July 15, 1958).

Evidence is presented for double E2 Coulomb excitation in targets of natural tungsten bombarded with oxygen ions from the Berkeley heavy-ion linear accelerator. Yield curves for the gamma-rays corresponding to the 2+ to ground and 4+ to 2+ transitions are presented, for bombarding energies from 30 to 80 MeV. The curve for the latter transition is compared with a normalized theoretical excitation function for the double E2 process, giving agreement except at the higher energies. The theoretical value of absolute yield at 40 MeV was calculated as 1.19×10^5 photons per microcoulomb, assuming that $B_{E_2}(2 \rightarrow 4) / B_{E_2}(0 \rightarrow 2)$ is equal to 18/35 as expected from the theory of rotational states. This agrees well with the experimental value of $(1.10 \pm 0.17) \times 10^5$ photons per microcoulomb which corresponds to an average cross-section of 25 millibarns for the double excitation process. It is unlikely that this cross-section could be explained by E4 excitation. A.E.I. Research Laboratory

539.17

7379. CONTRIBUTION TO THE STUDY OF EXCHANGE CURRENT EFFECTS IN DEUTERON PHOTODISINTEGRATION. P.Meyer.
Ann. Phys. (Paris), Ser. 13, Vol. 2, No. 7-8, 498-550 (July-Aug., 1957). In French.

The author reviews the phenomenological treatment of exchange current and gives a theoretical expression in a covariant form for the transition probability from the bound state of the deuteron, using Bethe—Salpeter wave-functions. The last two chapters are devoted to the choice of approximations and final evaluation. The electromagnetic interaction kernel of the nucleon—meson system is expanded to fourth order in the meson—nucleon coupling constant and to first order in the charge (the diagrams representing contributions from the anomalous nuclear magnetic moment are neglected). The Bethe—Salpeter wave-functions are replaced by their adiabatic approximation. The final evaluation is given only by using Hulthen wave-function for the bound state and free plane wave for the final state [this makes the generality of the treatment somewhat illusory]. J.Lascoux

539.17 : 539.14

7380. ON THE WIDTH OF THE GIANT RESONANCE IN PHOTONUCLEAR REACTIONS. S.A.E.Johansson.
Ark. Fys., Vol. 13, Paper 26, 331-8 (1958).

A compilation was made of the width of the giant resonance in photonuclear reactions. The experimental material is discussed and

it is shown in which cases the measured cross-section curves represent the total photonuclear absorption. It turns out that the non-deformed nuclei have a rather constant width. The width of the deformed nuclei is larger and shows considerable fluctuations. The theoretical implications of these facts are discussed. A.

539.17

7381. PHOTOPROTONS FROM OXYGEN. C.Milone, S.Milone-Tamburino, R.Rinzivillo, A.Rubbino and C.Tribuno. Nuovo Cimento, Vol. 7, No. 6, 729-41 (March 16, 1958). In Italian.

The spectrum of photoprotons produced by γ-rays with maximum energies 23, 26 and 30 MeV has been measured. A fine structure appears, with γ-absorption peaks in agreement with other authors. New peaks are found at the higher energies, not previously examined. The cross-section for leaving N^{15} in the ground state is derived, and the giant resonance found at $E\gamma = 22$ MeV. The cross-section including excited states is deduced approximately. R.J.N.Phillips

539.17

7382. ON HIGH ENERGY PHOTONEUTRONS. A.Agodi. Nuovo Cimento, Vol. 8, No. 3, 516-18 (May 1, 1958).

To explain an observed peak between 4 and 6 MeV, in the energy spectrum of photoneutrons (contributing about 10% of the total yield) the author assumes the following: directly emitted photoneutrons have to be observed on the average, with the energy of the virtual shell-model state in which they move just before leaving the nucleus. Preliminary calculations are reported for around A = 50; the peak is obtained at 5 MeV, with a contribution of the observed magnitude. An interesting departure is predicted for Rh^{103}, with a "fast" peak around 8 MeV, originating from the $1\,h_{9/2}$ virtual state. J.Lascoux

539.17

7383. THE SMALL ANGLE SCATTERING OF HIGH ENERGY PHOTONS IN URANIUM. J.Moffatt and M.W.Stringfellow. Phil. Mag. (Eighth Ser.), Vol. 3, 540-2 (May, 1958).

Differential cross-sections were measured for small-angle scattering of photons of mean energy 90 MeV in uranium, and found to decrease monotonically from about 170 barns/ster at 1.2 milliradians to about 40 barns/ster at 4.5 milliradians. Inelastic scattering processes which are counted together with the elastic scattering events, are considered: Compton scattering contributes 7.3 barns/ster while secondary processes such as pair production followed by bremsstrahlung are estimated to have a similar effective cross-section under the conditions of the experiment, both being substantially constant over the range of angles investigated. The forward peak in the experimental distribution is therefore presumably due to elastic scattering processes. Nuclear Thomson scattering is negligible, and while there is no complete theory for Rayleigh scattering at this energy, a form factor calculation leads to a differential cross-section of 6 barns/ster at the smallest angle of measurement. It is therefore concluded that the main contribution to elastic scattering is Delbrück scattering or potential scattering in the Coulomb field of the nucleus. The observed differential cross-sections agree, within experimental error, with those for Delbrück scattering calculated by Bethe and Rohrlich (Abstr. 4580/1952) if a uniform (inelastic) background cross-section of 18 barns/ster is assumed. P.K.Kabir

539.17 : 539.14

7384. TWO MODELS FOR THE NUCLEAR PHOTOEFFECT. J.S.Levinger. Rev. Mexicana Fís., Vol. 5, No. 4, 177-84 (Oct., 1956). In Spanish.

The Migdal–Jensen collective model and the Wilkinson shell model both give reasonable agreement with photonuclear experiments concerning the integrated cross-section, the resonance energy, and the width of the resonance. Possible reasons are discussed for the similarity between the predictions of the two different models. Experiments on emission of fast nucleons show that the excited state reached by electric dipole photon absorption contains a large emplitude of shell-model wave-functions representing single-particle excitation. A.

539.17

7385. RELATIVE MEASUREMENTS OF THE INTEGRATED CROSS-SECTION FOR THE NUCLEAR PHOTOEFFECT: THE REACTION $Ca^{44}(\gamma,p)K^{43}$. P.Brix, U.Hegel, K.H.Lindenberger and D.Quitmann. Z. Phys., Vol. 150, No. 4, 461-73 (1958). In German.

Ca is irradiated with betatron bremsstrahlung and the K^{43} coming from Ca^{44} is identified with a scintillation γ-spectrometer. From a measurement relative to the well-known $C^{12}(\gamma,n)$ reaction, an integrated cross-section of 125 ± 25 MeV millibarn was obtained. The evaluation depends on the fact that the difference in the spectrum of γ-rays coming through 18 mm of lead and the unfiltered betatron spectrum is, in the energy region of interest, approximately constant with energy. Through linear combinations with other constants, spectra which go approximately as $1/E$ or $1/E^2$ can be obtained. These are convenient for the relative measurements of the integrals over σ/E and σ/E^2, which give quantities important in the theoretical analyses. G.E.Brown

539.17

7386. DETERMINATION OF TOTAL CROSS-SECTIONS OF NEUTRONS OF 13.0 - 16.2 MeV ENERGIES [FOR Al, Fe, Ni, Cu, Zn, Ag, Sn, Hg, Pb, Bi]. M.Mazari, F.Alba and V.Serment. An. Inst. Fís., Vol. 1, 69-79 (1955). In Spanish.

539.17

7387. THE ANGULAR CORRELATION OF NEUTRONS FROM THE $Be^9(n,2n)Be^8$ REACTION. B.Torki, K.Winter and E.Rémy. C.R. Acad. Sci. (Paris), Vol. 246, No. 21, 3047-50 (May 28, 1958). In French.

Using a pair of scintillation counters in fast coincidence, the angular correlation of the neutrons from the $Be^9(n,2n)Be^8$ reaction was measured for an incident neutron energy of 14 MeV. The result obtained, by comparing coincidence versus angle curves from Be and C targets, was that the correlation rose to a maximum of 20% at 60° to the incident beam. A.E.I. Research Laboratory

539.17

7388. ISOTOPIC ASSIGNMENT OF SLOW NEUTRON RESONANCES IN GERMANIUM, RUBIDIUM, NEODYMIUM AND TUNGSTEN. E.M.Bowey. Nuclear Phys., Vol. 3, No. 4, 553-60 (June, 1957).

The gamma-ray yields due to neutron capture in isotopic samples of germanium oxide (GeO_2), rubidium chloride, neodymium oxide and tungsten trioxide were measured, and the results are recorded graphically for Ge^{70}, Ge^{72}, Ge^{73}, Ge^{74}, Ge^{76}, Ru^{99}, Ru^{97}, Nd^{142}, Nd^{143}, Nd^{144}, Nd^{145}, Nd^{146}, Nd^{148}, Nd^{150}, W^{182}, W^{183}, W^{184} and W^{186}, together with histograms showing the sample compositions in mg/cm². The neutrons were obtained in a collimated beam from the 15 MeV linear accelerator at Harwell. Each sample was mounted in a thin-walled aluminium can and suspended normal to the axis of the neutron beam in the centre of a cubical aluminium box containing a mixture of B_4C chips and water. Sodium iodide crystal detectors were recessed into the faces of the box so that they surrounded the sample. Under the experimental conditions used, the detector responded to gamma-rays due to neutron capture in the B_4C of neutrons scattered by the sample, as well as to those due to neutron capture in the sample itself. In this way, scattering resonances can also be identified, but with a lower efficiency than that for the identification of capture resonances. B.J.Wilson

539.17

7389. (n,p) REACTIONS IN Mg, Ni, Cu, Rh, AND Pd AT 14 MeV. V.V.Verbinski, T.Hurlimann, W.E.Stephens and E.J.Winhold. Phys. Rev., Vol. 108, No. 3, 779-82 (Nov. 1, 1957).

Emitted protons were observed from foils of Mg, Ni, Cu, Rh, and Pd bombarded with 14 MeV neutrons. Measurements were made of cross-sections and energy and angular distributions for protons of energies greater than 5 MeV. The results indicate that a relatively direct interaction between incident neutron and emitted proton is an important process in (n,p) reactions in medium-weight nuclei. A.

539.17

7390. POLARIZATION IN NUCLEAR REACTIONS. J.N.Lyness. Proc. Phys. Soc., Vol. 71, Pt 5, 858-60 (May, 1958).

An attempt was made to fit the observed polarization in the scattering of neutrons from medium-weight nuclei using a square-well optical model modified by two different forms of spin orbit term which are capable of exact solution. A "suprisingly close" fit is obtained using these modifications with a trapezoidal well. The differential cross-section and polarization for 380 keV neutrons off Mo^{96} are fitted using a trapezoidal well and a further form of spin orbit term. A.E.I. Research Laboratory

539.17

7391. MEASUREMENT OF THE ABSORPTION CROSS-SECTION FOR FAST NEUTRONS. T.S.Belanova. Zh. éksper. teor. Fiz., Vol. 34, No. 3, 574-8 (1958). In Russian.

The absorption cross-sections for 25, 220 and 830 keV photoneutrons are obtained for 20 elements. A.

539.17 : 539.12

THERMAL-NEUTRON DATA FOR THE ELEMENTS.

See Abstr. 7252

539.17 : 539.12

7392. BREMSSTRAHLUNG OF π-MESONS AND π-MESON PAIR FORMATION BY γ-QUANTA IN COLLISIONS [OF π-MESONS] WITH NON-SPHERICAL NUCLEI. I.T.Dyatlov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 80-6 (1958). In Russian.

Effective cross-sections are computed for a number of radiative processes arising in the interaction of high energy π-mesons with non-spherical nuclei. Non-sphericity of the nuclei modifies the angular distributions and leads to the appearance in the cross-sections of factors which are dependent only on the geometrical shape of the nucleus. A.

539.17 : 539.18

7393. SCATTERING OF μ-MESONS IN BERYLLIUM.
V.G.Kirillov-Ugryumov and A.M.Moskvichev.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 322-6 (1958). In Russian.

Scattering of μ-mesons with momenta (130 ± 16) MeV/c was investigated for beryllium plates. The observed angular distribution agrees within the limits of the statistical results with the distribution expected for a Coulomb interaction between μ-mesons and atoms of the substance. A.

539.17

7394. FISSION-PRODUCT YIELDS FROM U, Th AND Pu.
S.Katcoff.
Nucleonics, Vol. 16, No. 4, 78-85 (April, 1958).

Nucleonics data sheet No. 24. Fission-product yields from U^{233}, U^{235}, U^{238}, Pu^{239} and Th^{232} are tabulated and a chart given showing the decay chains and yields from thermal fission of U^{235} of 80 fission products. Full references are included. R.D.Smith

539.17

7395. DISTRIBUTION OF FISSION NEUTRON NUMBERS.
J.Terrell.
Phys. Rev., Vol. 108, No. 3, 783-9 (Nov. 1, 1957).

It is shown, on reasonable assumptions as to the distribution of excitation energy among fission fragments, that the probabilities P_ν of observing ν neutrons from fission are given approximately, in cumulative form, by the Gaussian distribution:

$$\sum_{n=0}^{\nu} P_n = (2\pi)^{-\frac{1}{2}} \int_{-\infty}^{(\nu - \bar{\nu} + \frac{1}{2} + b)/\sigma} \exp(-t^2/2)dt,$$

where $\bar{\nu}$ is the average number of neutrons, related to the average total excitation; b a small adjustment ($b < 10^{-2}$); and σ the root-mean-square width of the distribution of total excitation in units of the average excitation energy change E_0 per emitted neutron. It is shown that all experimental data on neutron emission probabilities are reasonably well represented by this distribution with $\sigma \cong 1.08$, with the exception of Cf^{252}, which requires $\sigma = 1.21 \pm 0.01$. An estimate that $E_0 = 6.7 \pm 0.7$ MeV gives an excitation energy distribution and a rate of change of $\bar{\nu}$ with incident neutron energy ($d\bar{\nu}/dE_n \cong 1/E_0$) in reasonable accord with experiment. These conclusions should also hold approximately for fission induced by higher energy neutrons, in which case a few neutrons may be emitted before fission. A.

539.17

7396. MEASUREMENT OF THE Xe^{135} CROSS-SECTION AND U^{235} FISSION YIELD OF I^{135}. G.R.Hopkins and C.P.Jamieson.
J. appl. Phys., Vol. 28, No. 11, 1362-3 (Nov., 1957).

This was made by following the changes in reactivity of a zero-power reactor (Reactivity Measurement Facility) when a previously irradiated sample of uranium, highly enriched in U^{235}, was placed inside it. The product $\sigma_a\gamma_1 = (1.47 \pm 0.07) \times 10^{-19}$ cm^2, (σ_a = capture cross-section of Xe^{135} at room temperature, γ_1 = fission yield of I^{135}) giving a value of σ_a at 300°K of 2.17×10^{-18} cm^2 if a yield of 6% for I^{135} is taken. A.O.Stanesby

539.17

7397. COMPARISON OF NEUTRON SPECTRA IN THE FISSION OF U^{233}, U^{235}, PU^{239}.
V.P.Kovalev, V.N.Andreev, M.N.Nikolaev and A.G.Guseĭnov.
Zh. éksper. teor. Fiz., Vol. 33, No. 4 (10), 1069-70 (1957). In Russian.
English translation in: Soviet Physics—JETP (New York), Vol. 6, No. 4, 825-6 (April, 1958).

Threshold detectors and fission cameras were used to examine the neutrons. Those from fission of U^{233} and Pu^{239} were found to be harder than those from U^{235}. On the basis of evaporation models, temperatures for U^{233} and Pu^{239} fragments are 1.02 ± 0.01 and 1.06 ± 0.01 MeV respectively, adopting T = 1.00 MeV for the fragments of U^{235}. A.E.I. Research Laboratory

539.17

7398. MASS DISTRIBUTION OF FISSION PRODUCTS PRODUCED BY IRRADIATION OF GOLD AND URANIUM BY NITROGEN IONS.
N.I.Tarantin, Yu.B.Gerlit, L.I.Guseva, B.F.Myasoedov, K.V.Filippova and G.N.Flerov.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 316-21 (1958). In Russian.

The authors investigated mass spectrum of the fission framents produced by irradiating thick targets of gold and uranium with 115 MeV nitrogen ions. Fourteen different elements were separated from the irradiated targets. The mass distribution curve for fission fragments produced by irradiating gold has the form of a narrow peak with a half-width of about 20 mass units. The maximum of the peak is at A ~ 100. The width of the mass distribution curve for fission fragments of irradiated uranium is much larger. A.

539.17

7399. FISSION OF ROTATING NUCLEI. G.A.Pik-Pichak.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 341-5 (1958). In Russian.

An expression was obtained for the fission barrier of a rotating nucleus. The fission cross-section is estimated for the reaction of N^{14} ions on heavy nuclei. A.

539.17

7400. NEUTRONS OF POSSIBLE THERMONUCLEAR ORIGIN.
W.C.Elmore, E.M.Little and W.E.Quinn.
Phys. Rev. Letters, Vol. 1, No. 1, 32-4 (July 1, 1958).

Low inductance, 100 kV, 0.88 μf capacitors were discharged into three coaxial single turn coils on a 5 cm bore ceramic tube. With this tube empty, the central magnetic field rises to 58 kgauss in 1.25 μsec. When the tube is filled with deuterium at between 5 and 500 μ of Hg, neutrons are emitted for 1 μsec during the second and subsequent current maxima, with a maximum yield of 10^6 neutrons at 100 μ of Hg. X-rays of upto 200 keV are observed, but because these behave differently with regard to time of occurrence, pressure, r.f. pre-excitation and impurities, the authors conclude that most of the neutrons arise from D-D collisions in adiabatically compressed plasma. R.S.Pease

539.17

7401. SIMULATING NUCLEAR BLAST EFFECTS.
J.R.Bohannon, Jr and W.E.Baker; F.B.Porzel; R.W.Deuster.
Nucleonics, Vol. 16, No. 3, 74-77, 78, 79 (March, 1958).

The Air Force Nuclear Engineering Test Reactor was designed to ensure absolute containment of all activity released by the maximum credible nuclear explosion. In order to study the effect of blast on the structure a quarter-scale model was built and geometrically scaled charges of explosive detonated in the core tank. Ten charges, equivalent to energy releases ranging from 21 MW sec to 1000 MW sec, were fired. Three charges were propellant and the rest explosive similar to TNT. The validity of the scaling laws and the differences between chemical and nuclear explosions are discussed. The damage caused by the explosive is greater than by the propellant, but it is thought that a nuclear explosion would more nearly resemble the propellant. It is concluded that, with minor modifications, the structure can stand releases up to 100 MW sec, three times the maximum credible energy release. Criticisms are made by Porzel and Deuster, to which the authors reply.

R.D.Smith

539.17 : 536.7

7402. THERMODYNAMICS OF GAS-COOLED REACTORS.
G.B.Melese.
Nucleonics, Vol. 16, No. 2, 72-6 (Feb., 1958).

Equations showing the relation of the performance of gas-cooled reactors to the basic parameters are derived with a few simplifying assumptions. Lines of constant net power, constant-pumping to thermal-power ratio, and constant net efficiency are plotted for the conditions of the central fuel channel. The analysis can then be extended to the whole reactor. A first estimate of the optimum parameters for power reactor design can be obtained. R.D.Smith

539.17

7403. XENON SPATIAL OSCILLATIONS.
D.Randall and D.S.St.John.
Nucleonics, Vol. 16, No. 3, 82-6, 129 (March, 1958).

When large thermal reactors are operated above the critical power level, spatial oscillations of reactor power can occur. These are due to local accumulation of xenon in one part of the reactor which is magnified by the reduction in xenon burnup due to the local reduction in flux. A perturbation method of calculating the oscillation threshold is developed using the steady-state xenon distribution calculated from the flux distribution obtained from one-group theory. The method follows that due to Ward (Abstr. 7403/1957), but the effect of power coefficient is included and the solution is expressed in terms of the flux shape. It is shown that xenon oscillations cannot occur in any reactor at flux levels below 3.5×10^{11} n cm^{-2} sec^{-1}. Positive power coefficients lower the instability threshold, while

negative coefficients raise the threshold and, if large, suppress the oscillations completely. In some cases the calculation can be simplified by expressing the perturbation on terms of the reactor geometry rather than the flux shape. The oscillations have a period of 20-30 hr and can be suppressed by using a number of independent control rods distributed throughout the reactor. R.D.Smith

539.17

7404. BOILING-WATER-REACTOR INSTABILITY. J.A.Thie.
Nucleonics, Vol. 16, No. 3, 102, 104-111 (March, 1958).

The behaviour of five A.N.L. boiling water reactors is summarized. A simplified kinetic model using a single series feedback loop and one-group linear kinetic equations is used to illustrate the method of analysis. Instabilities can be measured experimentally using step or sine-wave variation of reactivity, but only approximate predictions of unstable conditions can be made. R.D.Smith

539.17

7405. A SIMPLIFIED P_3 APPROXIMATION METHOD FOR CALCULATING THERMAL UTILIZATION.
E.M.Page and R.L.Murray.
Nucleonics, Vol. 16, No. 3, 114-15 (March, 1958).

A method applicable to heterogeneous thermal reactors with plate-type fuel elements. The thermal utilization is computed in terms of the F and E factors of diffusion cell theory.

R.D.Smith

539.17

7406. PREDICTING REACTIVITY AT HIGH BURNUP. B.Wolfe.
Nucleonics, Vol. 16, No. 3, 116-121 (March, 1958).

A perturbation technique for calculating burnup effects allowing for spatial variation of the burnup. It is assumed that the flux distribution remains constant and only the flux level changes. The method gave good results in a case where it was compared with the results obtained from a series of multigroup calculations.

R.D.Smith

539.17 : 518.5

7407. EASY COMPUTATION OF ADJOINT FLUXES [IN NUCLEAR REACTORS]. B.Wolfe.
Nucleonics, Vol. 16, No. 3, 121 (March, 1958).

A method of using multigroup digital computer codes, written for the solution of the diffusion equations for the ordinary flux, for the solution of the adjoint equations by making simple substitutions in the input data. R.D.Smith

539.17 : 539.16.08

7408. SCINTILLATION-COUNTER ANALYSIS OF E.B.W.R. RADIOACTIVITY. S.J.Goslovich, J.H.Pingel and H.R.Fish.
Nucleonics, Vol. 16, No. 5, 94, 96, 97 (May, 1958).

Neutron-induced activities detected after 20 MW operation of E.B.W.R. (Experimental Boiling Water Reactor) include Mn^{56}, Na^{24}, F^{18} and Co^{58}. Fission-product activities detected all result from xenon and krypton, which apparently diffuse through the zircalloy cladding. The measured concentrations in the water, steam, air and parts of the plant are tabulated. R.D.Smith

539.17 : 518.5 : 621.317.79

7409. XENON-POISONING COMPUTER. J.J.Paul and J.R.G.Cox.
Nucleonics, Vol. 16, No. 5, 97-101 (May, 1958).

An electromechanical system built for use with the N.R.U. reactor. Transistors and magnetic amplifiers together with servomotors and tachometer generators operating at 400 c/s are used to solve the equations governing the concentration of Xe^{135} on a real time basis. The input is derived from a power-level recorder and the Xe^{135} concentration is displayed on a drum counter with an accuracy of 1%. R.D.Smith

539.17

7410. GAS-COOLED REACTOR FOR THE SOUTH OF SCOTLAND ELECTRICITY BOARD. P.J.Grant.
Nucleonics, Vol. 16, No. 5, 108-13 (May, 1958).

Details of the two reactors being built at Hunterston are given. The core is a cylindrical graphite lattice containing 250 tons of uranium in the form of rods 24 in. long and 1.15 in. diameter, canned in magnox. The coolant is CO_2 and the heat output 530 MW.

R.D.Smith

539.17

7411. REACTOR CONTROL STRATEGIES.
Nucleonics, Vol. 16, No. 5, 71-7 (May, 1958).

A summary of the control methods used in 22 power reactors. A comprehensive table gives details of the control systems, the reactivity controlled and the reactivity required for burn-up, poison over-ride and temperature compensation. The activating signals and compensating responses used for steady state operation in different classes of reactor are discussed. R.D.Smith

539.17

7412. SPECTRAL SHIFT CONTROL.
M.C.Edlund and G.K.Rhode.
Nucleonics, Vol. 16, No. 5, 80-1 (May, 1958).

Changing the ratio of H_2O to D_2O in a water-moderated reactor can produce large reactivity changes without affecting neutron economy. Increase of the proportion of hydrogen shifts the neutron spectrum so as to (a) decrease leakage, (b) decrease resonance absorption in fuel and fertile material, (c) increase capture in other materials, (d) decrease epi-cadmium fissions. This method of control enables a fuel burnup to > 30000 MW days/ton to be obtained with an enriched pressurized-water reactor. R.D.Smith

539.17

7413. FLUID POISON CONTROL OF BOILING WATER REACTORS. J.A.Thie.
Nucleonics, Vol. 16, No. 5, 82-3 (May, 1958).

Boric acid was used as a poison for controlling Borax II, Borax III and E.B.W.R. Methods of injection, estimation and removal are described and the amount of reactivity controlled is tabulated. R.D.Smith

539.17

7414. CONTROL ROD MATERIALS.
D.N.Dunning and W.E.Ray.
Nucleonics, Vol. 16, No. 5, 88-92 (May, 1958).

Boron, silver, cadmium, indium, hafnium and rare earth oxides are considered as control rods for nuclear reactors. Nuclear data, mechanical properties, corrosion resistance and radiation resistance are tabulated. R.D.Smith

539.17

7415. ON THE "INFINITE RETARDATION" APPROXIMATION IN THE STUDY OF THE TRANSIENT OF A NUCLEAR REACTOR.
U.Farinelli.
R.C. Accad. Naz. Lincei, Vol. 22, No. 5, 606-10 (May, 1957). In Italian.

Considers quantitatively, using one-group theory, the limits of validity of an approximation which ignores changes in the emission of delayed neutrons. R.J.N.Phillips

539.17

7416. THE PHYSICAL AND TECHNICAL BASES OF ATOMIC POWER. D.Ÿ.Blokhyntsev.
Ukrayin. fiz. Zh., Vol. 1, No. 3, 209-25 (1956). In Russian.

Survey report covering such topics as:- thermal neutron reactors, fast neutron reactors, the technical problems of reactor construction, the first atomic electric power station.

C.R.S.Manders

539.17

7417. ANALYTICAL SOLUTION OF THE MULTIPLE-GROUP THEORY IN REACTOR CALCULATIONS AND AN EXAMPLE FOR TWO GROUPS. A.Ziegler.
Z. angew. Phys., Vol. 9, No. 6, 293-301 (June, 1957). In German.

This method of solution is used to calculate the critical mass and flux-density distribution of neutrons in a reactor in the shape of an infinite cylinder fitted with a reflector. This arrangement can be built up, in the radial or axial direction, from zones of different media. These zones can represent inner blankets, various cooling channels etc., as well as variations in the age of the reactor materials. This solution is useful for calculations on fast reactors of sufficient size. A method for dealing with two dimensional problems is given. D.H.Lord

539.17

7418. THE DIFFUSION OF FISSION-INITIATING NEUTRONS IN A HOMOGENEOUS THERMAL REACTOR.
K.H.Höcker and F.Wagner.
Z. angew. Phys., Vol. 9, No. 6, 301-5 (June, 1957). In German.

The diffusion of neutrons originating from a localized source in a plain critical reactor is examined. Homogeneous reactors with no reflectors, in the form of a disk and of a sphere, formed the basis of these studies. The neutrons were injected in single pulses of from 10^{-9} to 10^{-5} sec. It is shown that the mathematical techniques used are applicable to both localized effects and to the behaviour of the reactor as a whole. The "importance function" is used in these calculations. D.H.Lord

539.17 : 539.15.08

- IN-PILE POWER MONITORING. See Abstr. 7326

ATOMS

539.18

7419. ON NEW ONE-ELECTRON EIGENFUNCTIONS FOR ATOMS WITH TWO AND MORE ELECTRONS. [Über neue Einelektron-eigenfunktionen für Atome mit zwei und mehr Elektronen]. W.Reinöhl.
Bonn Hanover/Hamburg: Ferd. Dümmlers Verlag (1958) 39 pp. In German.

The assumption of a constant effective charge in the usual wave-functions used in variational methods is inadequate. After discussing the variation of effective charge with distance, a new expression for a one-electron eigenfunction of a helium atom is suggested, $\psi(r) = A \exp\{-[1 + \exp(-\mu r/a_0)]r/a_0\}$, where μ is the variational parameter and A the normalization constant, which has suitable behaviour as $r \to 0$ and $r \to \infty$. Comparison of the total energy of the helium ground state, electron density, diamagnetic susceptibility and mean value of $\overline{r^2}$, show this to be better than the usual one-electron function $\exp(-\lambda r/a_0)$. Comparison is also made with the Hartree self-consistent field values and Hylleraas functions. The methods developed can be applied also to the ground state of the Li atom. M.J.Kearsley

539.18

7420. ON THE ASYMPTOTIC PHASE-SHIFTS IN THE METHOD OF PARTIAL WAVES IN CASE OF SCATTERING OF ELECTRONS ON THE THOMAS—FERMI ATOM. T.Gajewski.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 4-5, 232-7 (1958). In German.

Using the Buchdahl potential (Abstr. 6088/1956) the asymptotic formula of Henneberg (Abstr. 4255/1933) leads to integrable expressions. Comparison of the results with those obtained by numerical methods is given. P.Roman

539.18

7421. EXCITED STATES OF H^-. B.F.Gray and H.O.Pritchard.
J. chem. Phys., Vol. 28, No. 3, 519-20 (March, 1958).

Theoretical. An iterative perturbation-type calculation for 1sns levels of two-electron ions is compared with experiment for He and Li^+, it being found that the observed energy lies between the zeroth and first iterates, and within 1% of the latter. Applying the same method to H^-, the energies of these unstable Auger states with $n > 1$ can be predicted: the further the ns electron is excited, the lower the energy predicted, because electron repulsion dominates. Doubly excited states are also treated. J.Hawgood

539.18 : 530.145

7422. SOME COMMENTS ON PERTURBATION THEORY. B.F.Gray.
J. chem. Phys., Vol. 28, No. 4, 732-3 (April, 1958).

Discusses the validity of the transformation of the perturbation series used in Abstr. 8167 (1955), which involves splitting it into two series of opposite sign, and the permissibility of neglecting apparently divergent parts obtained in such procedures. Applications to the energy of the He atom and to the polarizability of the H atom show that such neglect may be permissible. The result for He in Abstr. 8167 (1955) is not as good as was quoted there, because of a numerical error. J.Hawgood

539.18

7423. SERIES EXPANSION OF THE FERMI PART η_0 OF THE TF FUNCTION. S.Kobayashi.
J. Phys. Soc. Japan, Vol. 12, No. 8, 980 (Aug., 1957).

539.18 : 541.124

7424. CHEMICAL SHIFT EFFECT IN INNER ELECTRONIC LEVELS OF Cu DUE TO OXIDATION. E.Sokolowski, C.Nordling and K.Siegbahn.
Phys. Rev., Vol. 110, No. 3, 776 (May 1, 1958).

The binding energies associated with K and L-levels in metallic copper and cuprous and cupric oxide were studied by magnetic analysis of photoelectrons produced by X-radiation. In all cases there is a shift towards greater binding energy on going from the metal to the oxide. D.M.Edwards

539.18

7425. ON THE $(2p)^2\ ^1S$ STATE SOLUTION OF THE NON-RELATIVISTIC SCHRÖDINGER HELIUM EQUATION. E.Holøien.
Proc. Phys. Soc., Vol. 72, Pt 1, 141-4 (July, 1958).

The method of Abstr. 1993 (1958) is applied to this state, using 20 parameters and ensuring orthogonality to the more important of the less excited states. J.Hawgood

539.18 : 535.332

ENERGY LEVELS IN NITROGEN ATOMS. See Abstr. 6805

539.18

7426. OPTICAL DETECTION OF HYPERFINE TRANSITIONS OF CAESIUM ATOMS.
F.Diamand, J.M.Legendre and T.Skalinski.
C.R. Acad. Sci. (Paris), Vol. 246, No. 1, 90-2 (Jan. 6, 1958). In French.

Observations are made upon the hyperfine Zeeman transitions $(4,m_F) \leftrightarrow (3,m_F + 1)$ and $(4,m_F + 1) \leftrightarrow (3,m_F)$ of caesium at frequencies of 9205.3 and 9179.8 Mc/s. Line-widths were measured to be ~ 7 kc/s. R.W.Nicholls

539.18

7427. TRANSITION BETWEEN HYPERFINE STRUCTURE LEVELS IN μ-MESIC HYDROGEN ATOMS. S.S.Gershteĭn.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 463-8 (1958). In Russian.

It is shown that due to the mechanism suggested by Ya.B. Zeldovich (Abstr. 6614/1957) of a "jump" of μ^--mesons from one proton to another, mesic hydrogen atoms completely convert to the ground state of the hyperfine structure during the lifetime of the μ-meson. A consequence of this is that the μ^--mesons are completely depolarized in hydrogen and that the neutrons produced in μ^--meson capture by protons, $\mu^- + p \to n + \nu$, are totally polarized in the direction of their motion. A.

539.18 : 539.166

7428. INFLUENCE OF THE POLARIZATION OF A μ^--MESON ON THE EFFECT OF CORRELATIONS OF γ-RAYS EMITTED BY A MESIC ATOM. V.A.Dzhrbashyan.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 260 (1958). In Russian.

A rather involved formula, including the statistical tensor of Fano and Racah coefficients, is given. G.E.Brown

539.18

7429. NEW REFERENCE NUCLIDE.
T.P.Kohman, J.H.E.Mattauch and A.H.Wapstra.
Science, Vol. 127, 1431-2 (June 20, 1958).

C^{12} is proposed as a new basis for a unified physical and chemical scale of nuclide masses and atomic weights. The advantages claimed are the convenience of C^{12} as an accessible mass spectroscopic standard and the fact that atomic weights on the chemical scale would be changed by only 43 p.p.m.. A.H.Cook

539.18 : 535.331

7430. ON THE SPECTRAL DETERMINATION OF THE ISOTOPIC COMPOSITION OF LEAD.
A.G.Zhiglinskiĭ, A.N.Zaĭdel' and Yu.Chaĭko.
Optika i Spektrosk., Vol. 4, No. 2, 152-5 (1958). In Russian.

A liquid-air cooled hollow cathode was used to excite the 4058 A line and its structure examined with a Fabry—Perot interferometer; the spectrum was recorded photoelectrically by means of a cooled photomultiplier. The Pb^{204} isotope line is resolved and with allowance for the hyperfine structure, Pb^{208}, Pb^{207} and Pb^{206} can be estimated to 2-4%. Comparisons with mass spectrometer results for samples with different isotopic compositions are given. L.Bovey

539.18

7431. A NEW ISOTOPE SEPARATION PROCESS.
F.Schultz-Grunow.
Z. angew. Math. Phys., Vol. 9b, No. 5-6, 628-36 (1958). In German.

The process is based on the thermal-diffusion effect cascaded by means of a forced, controllable, boundary-layer flow. This flow is produced in the gap between a rotating disk and a fixed housing, which are maintained at different temperatures. The experimental results are compared with results from other processes, and it is shown that the throughputs obtained are substantially greater than can be obtained from a conventional thermal diffusion column. H.C.Cole

539.18 : 539.12

7432. ELASTIC SCATTERING OF SLOW POSITRONS BY HYDROGEN ATOMS. B.L.Moiseiwitsch.
Proc. Phys. Soc., Vol. 72, Pt 1, 139-41 (July, 1958).

The calculation of electron scattering by Newstein (Technical Report, Research Laboratory of Electronics, Massachusetts Institute of Technology, No. 4, 1955), using the Schwinger variational method, is applied to positrons. The results do not satisfy the optical theorem. G.H.Burkhardt

539.18

7433. SCATTERING OF IONS ON ATOMS. O.B.Firsov.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 447-52 (1958). In Russian.

The dependence of the impact parameter on energy of relative motion and on the scattering angle, and also the diffusion

scattering cross-section in atomic collisions is calculated by employing the interaction potential between atoms determined on basis of the Thomas—Fermi statistical model of the atom.

A.

539.18 : 537.564

COLLISIONS BETWEEN FAST HYDROGEN ATOMS AND MOLECULES OF GASES. See Abstr. 7137

539.18

7434. CROSS SECTIONS FOR L-SHELL IONIZATION OF Ag BY PROTONS, DEUTERONS, AND ALPHA PARTICLES. B.Singh.
Phys. Rev., Vol. 108, No. 6, 1449-52 (Dec. 15, 1957).

A thin target of Ag is bombarded by protons, deuterons, and alpha particles of energies between 0.4 and 1.0 MeV. The charged particles are accelerated by a Van de Graaff machine and the resulting L X-rays of Ag are detected by a proportional counter of good resolution and high efficiency. The pulses from the counter are analysed by a fifty-channel pulse-height analyser and the number of X-ray quanta produced is determined by well-defined differential curves. After correcting for the Auger transition the absolute cross section for L-shell ionization is measured. The absolute cross section of L-shell ionization is larger than the K-shell ionization by a factor of 10^4 for the same proton energy. In the absence of a theoretical treatment for L-shell ionization, an empirical formula similar to the K-shell ionization formula is suggested. A.

539.18

7435. THE EFFECT OF RARE GASES ON THE DEGREE OF ORIENTATION OF SODIUM VAPOUR OBTAINED BY OPTICAL PUMPING. F.Hartmann, M.Rambosson, J.Brossel and A.Kastler.
C.R. Acad. Sci. (Paris), Vol. 246, No. 10, 1522-5 (March 10, 1958). In French.

Further studies were made of the pressure dependence (0-1 mm Hg) and the effect of rare gases (He, A, Kr, Ne, Xe) of the degree of orientation of sodium vapour which may be obtained by optical pumping. The effect maximizes between 0.1 and 0.5 mm Hg, depending upon the rare gas used. R.W.Nicholls

539.18 : 541.183 : 537.533.2

ELECTRIC DIPOLE MOMENT OF A NITROGEN ATOM ADSORBED ON TUNGSTEN. See Abstr. 7099

MOLECULES

530.19

7436. INVARIANT IMBEDDING RELATION FOR THE PRINCIPLES OF INVARIANCE. R.W.Preisendorfer.
Proc. Nat. Acad. Sci. U.S.A., Vol. 44, No. 4, 320-3 (April, 1958).

An explicit analytic statement of the principle of invariant imbedding is given for radiative transfer and neutron-transport processes. This yields the general symmetric forms of the principles of invariance for these processes. The discussion is limited to the steady state case on a class of inhomogeneous one-parameter carrier spaces. M.J.Kearsley

539.19

7437. ON THE THOMAS—FERMI EQUATION FOR HIGH TEMPERATURES. V.A.Erma.
Ann. Phys. (Leipzig), Vol. 20, No. 7-8, 345-8 (1957). In German.

A semi-convergent expansion of the Thomas—Fermi potential is derived with a view to obtaining, by numerical integration, the equation of state of an element at high temperatures (Feynman, Metropolis and Teller, Abstr. 4744/1949). W.A.Hepner

539.19

7438. FORCE CONSTANTS OF TETRAHEDRAL MOLECULES. C.W.F.T.Pistorius.
J. chem. Phys., Vol. 28, No. 3, 514-15 (March, 1958).

A previous paper (Abstr. 9773/1957) gave a method for evaluating five force constants from the most general harmonic P.E. expression. This was applied to some hydrides where the small stretching—stretching interaction constant f_{dd} has little effect on the other force constants. The present paper applies the same method to some molecules with larger f_{dd} values. J.Jacobs

539.19

7439. ROTATIONAL ANALYSIS OF THE $^2\Sigma-^2\Sigma$ SYSTEM OF AlO. A.Lagerqvist, N.E.L.Nilsson and R.F.Barrow.
Ark. Fys., Vol. 12, Paper 25, 543-6 (1957).

A rotational analysis of the well-known $^2\Sigma-^2\Sigma$ system is carried out, in which the levels $v' = 0, 1, 2$ and 3 and $v'' = 0, 1, 2, 3, 4$ and 5 are studied. No perturbations or predissociations were found in the region analysed. Rotational and vibrational constants are derived. A.

539.19

7440. ROTATIONAL ANALYSIS OF THE β-SYSTEM OF BO. L.Lagerqvist, N.E.L.Nilsson and K.Wigartz.
Ark. Fys., Vol. 13, Paper 30, 379-91 (1958).

Rotational analyses of nine bands of the $\beta(B\,^3\Sigma^+-X\,^3\Sigma^+)$ system of BO are carried out. Rotational and vibrational constants are derived. The constants for the upper level, $B\,^3\Sigma^+$, are as follows:

$B'_v = 1.5171-0.0210(v' + \frac{1}{2})$ cm^{-1}; $r'_e = 1.3053 \times 10^{-8}$ cm
$D'_e = 8.5 \times 10^{-6}$ cm^{-1}
$\omega'_e = 1281.69$; $\omega'_e x_e = 10.66$
$T'_e = 43174.05$.

A survey of the spectroscopic data for BO is given. A.

539.19

7441. COMMENTS ON THE INTERNAL ROTATION PROBLEM. D.R.Herschbach.
J. chem. Phys., Vol. 27, No. 6, 1420-1 (Dec., 1957).

The effects of higher-order perturbations on the barriers hindering internal molecular rotation are discussed. These perturbations are thought to account for certain discrepancies in the second-order treatments. G.I.W.Llewelyn

539.19

7442. VIBRATIONALLY EXCITED GROUND-STATE NITROGEN IN ACTIVE NITROGEN. F.Kaufman and J.R.Kelso.
J. chem. Phys., Vol. 28, No. 3, 510-11 (March, 1958).

Photoelectric luminosity measurements and thermocouple temperature measurements upon active nitrogen afterglow reactions with NO and N_2O suggest that vibrationally excited $N_2(X\,^1\Sigma)$ molecules are present in the glow together with those of $N(^4S)$. It also seems likely that NO quenches the N and independently N_2O quenches N_2. R.W.Nicholls

539.19

7443. NORMAL FREQUENCIES OF BIPYRAMIDAL $M(XY)_5$ MOLECULES. H.Murata and K.Kawai.
J. chem. Phys., Vol. 28, No. 3, 516-17 (March, 1958).

A normal co-ordinate treatment was carried out; all F matrix elements are listed here, the G matrix elements being obtained from Decius (Abstr. 646/1949) and Ferigle and Meister (Abstr. 8097/1952). Fundamental frequencies for $Fe(CO)_5$ were calculated and are in excellent agreement with observed values. J.Jacobs

539.19

7444. ON THE ORIGIN OF INTERACTION TERMS IN MOLECULAR VIBRATIONS. L.Burnelle and J.Duchesne.
J. chem. Phys., Vol. 28, No. 4, 726-7 (April, 1958).

An extension of the calculations of Duchesne and Monfils to determine the sign of cross-terms in the potential function of singly-bonded polyatomic molecules. Recent measurements of vibrational frequencies of the linear mercuric halides support these calculations, but the signs of cross-terms appear to be undetermined except in the case of s-p hybridization (+ve). R.C.Seymour

539.19

7445. CORRELATION OF MOLECULAR CONSTANTS. I. DEDUCTION OF RELATIONS. Y.P.Varshni.
J. chem. Phys., Vol. 28, No. 6, 1078-80 (June, 1958).

Making certain assumptions regarding constants in Sutherland's potential energy function, a number of relations have been derived between the molecular constants; viz., k_e, r_e, D_e, ω_e, etc. A.

539.19

7446. CORRELATION OF MOLECULAR CONSTANTS. II. RELATION BETWEEN FORCE CONSTANT AND EQUILIBRIUM INTERNUCLEAR DISTANCE. Y.P.Varshni.
J. chem. Phys., Vol. 28, No. 6, 1081-9 (June, 1958).

A new relation between force constant and equilibrium internuclear distance is suggested: $k_e(r_e-d)^2 = A$, where d and A are constants for each molecular group. The relation is examined for a number of molecular groups and found to be satisfactory. A.

539.19

7447. l-TYPE DOUBLING IN NH_3. J.S.Garing and H.H.Nielsen.
Proc. Nat. Acad. Sci. U.S.A., Vol. 44, No. 5, 467-72 (May, 1958).

Coriolis interaction in pyramidal molecules can arise from resonance between the parallel frequency ω_3 and the perpendicular frequency ω_4 and in the case of NH_3 leads to giant l-type splitting of the state K = 1. The theory of this effect in NH_3 is given and compared with the results of recent high resolution studies of the 6 μ band. R.C.Seymour

539.19

448. SENSITIVE VIBRATIONAL FREQUENCIES. III. EMPIRICAL RELATION FOR ELECTRONEGATIVITY APPLICABLE TO THE CALCULATION OF GROUP ELECTRONEGATIVITIES. J.K.Wilmshurst.
J. chem. Phys., Vol. 28, No. 4, 733-5 (April, 1958).
For Pt II, see Canad. J. Chem., Vol. 35, No. 8 (Aug., 1957).
A linear relation between the electronegativity of an atom or group X and the stretching frequency of HX is proposed. This agrees much better with other estimates of electronegativity than does Walsh's relation using the stretching force constant (Abstr. 7157/1951). J.Hawgood

539.19

449. ELECTRONIC STRUCTURE OF SOME DIATOMIC HYDRIDES. M.Krauss.
J. chem. Phys., Vol. 28, No. 6, 1021-6 (June, 1958).
The self-consistent field molecular orbital (SCF-MO) method is applied to the calculation of the ground states of the CH, CH^+, NH, OH, and FH molecules. Results are reported for the ionization potentials, excitation energies, binding energies, and dipole moments. The relative behaviour of the bonding in these molecules is exhibited by an electron distribution analysis and the importance of σ-p promotion in a single configuration description of these molecules is emphasized. A.

539.19 : 537.562

450. SOME ELECTRON COLLISION CROSS SECTIONS FOR NITROGEN AND OXYGEN. D.T.Stewart and E.Gabathuler.
Proc. Phys. Soc., Vol. 72, Pt 2, 287-9 (Aug., 1958).
Describes excitation functions and excitation cross-sections (electron impact) for the second positive bands of N_2 ($C^3\Pi_u$-$B^3\Pi_g$), and the first and second negative bands of O_2^+ (respectively $^4\Sigma_g^-$-$^4\Pi_u$ and $A^2\Pi_u$-$X^2\Pi_g$). Cross-sections are tabulated. J.D.Craggs

537.562 : 539.19

ELECTRON COLLISION CROSS-SECTIONS FOR NITROGEN AND OXYGEN. See Abstr. 7450

539.19

451. THE IMPORTANCE OF THE HARTREE ATOMIC EIGENFUNCTIONS IN QUANTUM CHEMISTRY. K.Artmann.
Z. Phys., Vol. 150, No. 5, 573-89 (1958). In German.
When calculating the molecular energy with a previously developed method of the author (Abstr. 5448/1958), there appears an error depending on the internuclear separation. This error is small if one uses the Hartree functions, but for Slater functions it may become significant. P.Roman

539.19

452. DETERMINATION OF FRACTIONAL STERIC INHIBITION OF RESONANCE FROM σ_R VALUES. R.W.Taft,Jr, and H.D.Evans.
J. chem. Phys., Vol. 27, No. 6, 1427-8 (Dec., 1957).
The change in Hammett σ value on alkylation is as good a measure of resonance inhibition in certain organic ions and esters as is the change in maximum ultraviolet extinction coefficient. This is shown by calculations from published data on the effects of methyl and iodo groups on resonance of nitro, dimethylamino and methoxy groups in anilinium ions and benzoate esters, and on related polar effects and spectra. J.Hawgood

539.19

453. ELECTRON SPIN RESONANCE IN A STABLE PHENOXY RADICAL. J.J.Windle and W.H.Thurston.
J. chem. Phys., Vol. 27, No. 6, 1429-30 (Dec., 1957).
Electron spin resonance was observed in polycrystalline samples of a free radical which the authors call Coppinger's radical since Coppinger (J. Amer. Chem. Soc., Vol. 79, No. 2, 501, Jan. 20, 1957) has described some of its properties. They also observed the resonance in solutions of various concentrations in benzene at low temperatures. They find a rounded line exchange narrowed at high concentrations, and a hyperfine structure at low concentration due to interaction of the unpaired electron with protons in the radical. This is interpreted in terms of the position of the unpaired electron in the radical. J.M.Baker

539.19

454. SPIN DENSITY IN OCTOCYANOMOLYBDATE (V). I.I.Weissman and M.Cohn.
J. chem. Phys., Vol. 27, No. 6, 1440-1 (Dec., 1957).
Electron spin resonance in $Mo(CN)_8^{3-}$ in aqueous solution exhibits a well resolved hyperfine structure due to Mo^{95} and Mo^{97}. A pair of satellites on each line was attributed to hyperfine structure interaction with the nuclear moment of C^{13} in the ligands, and this was confirmed by using a sample enriched in C^{13} concentration. From this hyperfine structure and assuming that the line width is due to hyperfine structure interaction with the nitrogen nuclei the authors assign a spin density of 0.96 on the Mo, 0.088 on each C, and less than 0.006 on each N nucleus. J.M.Baker

539.19

7455. CARBONACEOUS FREE RADICALS IN CRUDE PETROLEUM. H.S.Gutowsky, B.R.Ray, R.L.Rutledge and R.R.Unterberger.
J. chem. Phys., Vol. 28, No. 4, 744-5 (April, 1958).
The electron spin resonance absorption occurring at g = 2.003, of several gauss width, which is observed in crude oils is attributed to asphaltene colloidal particles. This g-value and line width are very similar to those observed in coals and charcoals. The particles have molecular weight of 30 000, 40 A diameter, and an average of 0.4 free spins per particle. The resonance is attributed to incomplete carbon bonds and may be related to the geological conditions under which the oil was formed. Observation of the resonance might form a convenient empirical means of estimating the concentration of colloidal carbonaceous particles in oil. J.M.Baker

539.19

7456. SIGN OF THE CUBIC FIELD SPLITTING FOR Mn^{++} IN ZnS. G.D.Watkins.
Phys. Rev., Vol. 110, No. 4, 986 (May 15, 1958).
Reports electron spin resonance measurements giving the relative intensities of transitions for Mn^{++} in ZnS at 4°K. These show that the cubic field splitting constant a and the hyperfine interaction constant reported by Matarrese and Kikuchi (J. Phys. Chem. Solids, Vol. 1, 117, 1956) should have their signs reversed; a is then positive in agreement with Watanabe's theoretical result. D.M.Edwards

539.19 : 535.343

PARAMAGNETIC RESONANCE OF HYDROCARBON SOLUTIONS. See Abstr. 6838

539.19

7457. INFLUENCE OF SOME PARAMAGNETIC IONS ON THE MAGNETIC RESONANCE ABSORPTION OF ALCOHOLS. W.D.Phillips, C.E.Looney and C.K.Ikeda.
J. chem. Phys., Vol. 27, No. 6, 1435-6 (Dec., 1957).
Shifts of the proton magnetic resonance frequency were observed in alcohols due to formation of complexes with dissolved paramagnetic salts. The shifts produced by Co^{++} and Mn^{++} complexes are less than those expected due to the bulk magnetization of the paramagnetic species while those produced by Ce^{+++} are as expected. This is explained in terms of a charge transfer mechanism resulting from bond formation between the paramagnetic ion and the alcohol. J.M.Baker

539.19

7458. PROTON RESONANCE SHIFTS IN PARAMAGNETIC METAL AROMATIC COMPLEXES. H.M.McConnell and C.H.Holm.
J. chem. Phys., Vol. 28, No. 4, 749-50 (April, 1958).
Shifts of the proton magnetic resonance frequency in complexes of the form $X(C_5H_5)_2$ (where X is a divalent ion of the 3d transition group) were observed. These are attributed to charge-transfer bonding between the X atom and the carbon atoms leaving an unpaired spin density on the protons. The authors made measurements on substances where X is Ni, V, Cr, Mn, and Co, and tentatively suggest that negative (or positive) spin densities on the ligands of the paramagnetic ions will be found most frequently for ions whose next lowest oxidation states have higher (or lower) spin multiplicities in the ground state. J.M.Baker

539.19

7459. NUCLEAR MAGNETIC RESONANCE EXPERIMENT ON SOLID HEXAMETHYLDISILANE.
T.Yukitoshi, H.Suga, S.Seki and J.Itoh.
J. Phys. Soc. Japan, Vol. 12, No. 5, 506-15 (May, 1957).
Proton magnetic resonance of solid hexamethyldisilane was studied. Line width and spin—lattice relaxation time were measured in the temperature range from liquid air to room temperature. By analysing these quantities the following results were obtained: (1) Even at liquid air temperature, each CH_3 group reorientates about its three-fold symmetry axis so rapidly as to narrow the dipolar width due to three proton interactions within itself (activation energy 2.6. kcal/mole). (2) At about −120°C, reorientation of CH_3 groups about the axis joining two silicon atoms becomes rapid enough to narrow the width further (activation energy 5.7 kcal/mole). Spin—lattice relaxation time varies qualitatively in accordance with the above considered reorientational motions. (3) At −51.3°C, this crystal changes its structure and at the same time rapid reorientational motion of the molecular axis is excited, resulting discontinuous

decrease in the line width and discontinuous increase in the spin–lattice relaxation time. Above the transition temperature, self-diffusion of molecule as a whole starts and the line width decreases gradually to zero (activation energy 10 kcal/mole). No change in the line width was observed at the melting point. A.

539.19

7460. CALCULATION OF THE CONSTANT OF NUCLEAR MAGNETIC SCREENING. I.V.Aleksandrov.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 4, 671-4 (1958). In Russian.

The screening, for molecules, can be calculated by the method of molecular orbitals. This involves obtaining the molecular wave-functions in a magnetic field to first order in the field strength. The method is illustrated by calculating the screening in the hydrogen molecule. G.E.Brown

539.19

7461. MOLECULAR ORBITALS IN THE $B_4H_7^-$ AND $B_6H_{11}^+$ IONS. W.N.Lipscomb.
J. chem. Phys., Vol. 28, No. 1, 170-1 (Jan., 1958).

A simplified MO treatment like that of B_5H_9 in Abstr. 8503 (1954) suggests that these ions (of C_{3v} and C_{5v} symmetry) should be stable, and that an ionic compound of the two might exist.

J.Hawgood

539.19

7462. SPIN DENSITY MATRICES FOR PARAMAGNETIC MOLECULES. H.M.McConnell.
J. chem. Phys., Vol. 28, No. 6, 1188-92 (June, 1958).

The density of electron-spin angular momentum (erg sec/cm^3) at a point x, y, z in a paramagnetic molecule is $\hbar S_Z\rho(x, y, z)$, where S_Z is the z component of the total electron spin angular momentum in units of $\hbar$. If the exact wave function for the molecule Ψ is built up from one-electron basis functions ψ_i, then the normalized spin density function $\rho(x, y, z)$ can be expressed in terms of the ψ_i and the spin density matrix ρ_{ij}

$$\rho(x, y, z) = \Sigma_{ij}\rho_{ij}\psi_j^*\psi_i.$$

If the ψ_i are molecular orbitals, then ρ_{ij} is the molecular orbital spin density matrix; if the ψ_i are atomic orbitals, then ρ_{ij} is an atomic orbital spin density matrix. The equation of conservation of spin is $\mathrm{Tr}(\mathbb{S}\rho) = 1$, where $\mathbb{S}$ is the nonorthoginality matrix, $\mathbb{S}_{ij} = \langle\psi_i|\psi_j\rangle$. The elements of the spin density matrices are sensitive to overlap and electron correlation effects. This is illustrated by calculations of the spin density matrices of the ethylene positive ion radical, and of the allyl radical. The spin density matrix for the latter molecule is calculated using (a) the simple molecular orbital approximation, (b) the simple valence bond approximation, and (c) the complete π-electron interaction configurational treatment given by Chalvet and Daudel. It is shown that the general connection between σ-proton hyperfine splittings a_N and the π-electron atomic orbital spin density matrix $\rho_{NN'}$, involves a (hyperfine interaction)-(exchange interaction) matrix $Q_{N'N''}^{N}$ such that

$$a_N = \mathrm{Tr}(Q^N\rho).$$

However, for practical calculations, observed hyperfine splittings may be used to estimate the diagonal elements of the spin density matrix,

$$a \cong Q\rho_{NN'}$$

where Q has the semiempirical value of −63 Mc/s or −23 gauss.

A.

539.19

7463. STRUCTURE OF ETHYLENE.
L.S.Bartell and R.A.Bonham.
J. chem. Phys., Vol. 27, No. 6, 1414-15 (Dec., 1957).

This was investigated by using the electron diffraction apparatus described in Abstr. 9294 (1954), taking into account as far as possible the large amplitude, asymmetry and anharmonicity of the vibrations. The results for bond lengths and the H–C–H angle (116°) differ somewhat from those normally used. J.Hawgood

539.19

7464. PLANARITY OF THE FORMIC ACID MONOMER.
R.Trambarulo, A.Clark and C.Hearns.
J. chem. Phys., Vol. 28, No. 4, 736-7 (April, 1958).

Microwave measurements were made and lines in the range 9000-58 000 Mc/s are tabulated, with assignments. Calculated values of the three moments of inertia indicate a planar molecule.

G.F.Lothian.

539.19

7465. EVIDENCE FOR THE NORMAL CYANIDE STRUCTURE OF $(CH_3)_3SiCN$. H.R.Linton and E.R.Nixon; H.C.Beachell.
J. chem. Phys., Vol. 28, No. 5, 990-1, 991 (May, 1958).

Linton and Nixon report that experimental and calculated results for isotopic shifts in the infrared spectra of polycrystalline films of solid $(CH_3)_3SiCN$ at −190°C indicate the normal cyanide structure for this compound. Beachell comments that the spectral evidence given is a necessary but not sufficient criterion of the structure. R.C.Seymour

539.19

7466. ELECTRON DIFFRACTION STUDY OF LEAD TETRAMETHYL. Chi-Hsiang Wong and V.Schomaker.
J. chem. Phys., Vol. 28, No. 6, 1007-9 (June, 1958).

A reinvestigation of $Pb(CH_3)_4$ showed the diffraction patterns to be in agreement with a symmetrical molecular structure and the complex atomic scattering factors of Ibers and Hoerni. The measured interatomic distances are Pb–C = 2.203 ± 0.010 A and Pb ...H = 2.79 ± 0.05 A. A

539.19

7467. ELECTRON DIFFRACTION STUDY OF TRIFLUOROMETHYL IODIDE. Chi-Hsiang Wong and V.Schomaker.
J. chem. Phys., Vol. 28, No. 6, 1010-13 (June, 1958).

A reinvestigation of CF_3I by electron diffraction for this molecule confirmed the complex atomic scattering factors of Ibers and Hoerni. The structural parameters agree with those reported from earlier, inconclusive determinations. A.

539.19

7468. DIPOLE DERIVATIVE OF LITHIUM HYDRIDE.
W.G.Norris and W.Klemperer.
J. chem. Phys., Vol. 28, No. 4, 749 (April, 1958).

The ratio of intensities of 16 pairs of lines in the P and R-branches of the 0–1 band in the rotation–vibration spectrum of LiH was used to calculate, by means of the theory of Herman and Wallis (Abstr. 5317/1955),

$$\theta = \frac{\mu_e}{\left(\frac{d\mu}{dr}\right)_{r_e} \cdot r_e}$$

where μ_e is the dipole moment at the equilibrium distance r_e. The value of θ (+1.5 ± 0.3) is compared with calculated values, e.g. model of polarizable ions gives $\theta < 1$, while from LCAO-CI calculations θ = +4.5. R.C.Seymour

539.19

7469. Mg–N BOND LENGTH IN CHLOROPHYLL. L.S.Levitt.
J. chem. Phys., Vol. 28, No. 3, 515-16 (March, 1958).

From the distance between the central pyrol N atoms, determined by X-ray diffraction, the true Mg–N distance is calculated as 1.95 A, less than the sum of their covalent radii. This shortening can be explained by postulating resonance structures with two double bonds, with some ionic character superimposed on all six bonds. In the ground state the Mg atom would then have an outer configuration $3s^2\,3p^6\,3d^4$. This sp^3d^2 hybridization leads to an octohedral configuration with a square planar structure of the $Mg–N_4$ system.

J.Jacobs

539.19 : 535.343

EQUILIBRIUM CONFORMATION OF PROPYLENE. See Abstr. 6851

539.19 : 535.347

INTERPRETATION OF INFRARED DICHROISM IN AXIALLY ORIENTED POLYMERS. See Abstr. 6861

539.19

7470. RADIATIVE COLLISIONS BETWEEN MOLECULAR AND ELECTRON BEAMS. II. ANGULAR MOMENTUM DISTRIBUTION OF OH* RADICALS SPLITTING FROM H_2O_2 MOLECULES.
T.Horie, T.Nagura and M.Otsuka.
J. Phys. Soc. Japan, Vol. 12, No. 5, 500-5 (May, 1957).

For Pt I, see Abstr. 4451 (1957). A spectroscopic study of the radiative collision of electrons with H_2O_2 molecules leads to a pronounced abnormal rotation of the OH* radical split by electron impact from H_2O_2. A homogeneous electron beam was fired at right angles across a localized jet of H_2O_2 vapour in a vacuum chamber maintained at a pressure of about 1×10^{-4} mmHg. The angular momentum distribution curve obtained shows a single maximum which is located near the rotational quantum number of 20, and the rotational temperature corresponds to 20 100°K, being remarkably higher than the initial gas temperature. In comparison with the double maxima found for H_2O, there are two differences, namely—

he absence of the first maximum and the shift of the second max-.mum towards higher rotational quantum numbers. A.

539.19

7471. RADIATIVE COLLISIONS BETWEEN MOLECULAR AND ELECTRON BEAMS. III. ANGULAR MOMENTUM DISTRIBUTION OF OH* RADICALS LIBERATED FROM ALCOHOL MOLECULES. T.Horie, M.Otsuka and T.Nagura.
J. Phys. Soc. Japan, Vol. 12, No. 10, 1099-104 (Oct., 1957).

For Pt II see preceding abstract. The light induced when a homogeneous electron beam (500-700 eV) intersects normally a localized jet of methyl, ethyl, or n-propyl alcohol vapour in a vacuum of 10^{-4} mmHg was found to be almost entirely due to the emission from the fragments H*, CH* and, OH*. The angular momentum distributions of the OH* radicals split from alcohol molecules of the respective species were measured by the molecular spectrophotometric method. They all differ notably from that previously found for OH* from H_2O, that is, the first maximum appears near the rotational quantum number 7 and the second maximum is entirely absent except for OH* from CH_3OH. Qualitative discussions are also given to the multiple fragmentation by electron impact of these alcohol molecules. A.

539.19

7472. COLLISIONAL DEACTIVATION OF EXCITED CYCLOOCTATETRAENE MOLECULE. H.Yamazaki and S.Shida.
J. chem. Phys., Vol. 28, No. 4, 737-8 (April, 1958).

One product of the mercury photosensitized reaction previously investigated by the authors (Abstr. 7789/1956) is C_2H_2 produced by $C_8H_8^* \rightarrow C_6H_6 + C_2H_2$. Addition of a rare gas reduces the production of C_2H_2 attributed to collisional deactivation of $C_8H_8^*$.

G.F.Lothian

539.19

7473. INTERMOLECULAR POTENTIALS OF ARGON, METHANE, AND ETHANE. A.G. De Rocco and J.O.Halford.
J. chem. Phys., Vol. 28, No. 6, 1152-4 (June, 1958).

The viscosities of argon, methane, and ethane are reported over a temperature range from ~ 210°K to ~ 475°K. In conjunction with second virial coefficient data, the viscosities are employed to estimate the potential parameters for an exp : 6 potential. For the spherically symmetric molecules a single set of parameters served to reproduce the equilibrium and transport properties with serviceable accuracy. For ethane the procedure failed, and this failure was taken as further evidence for the fundamental inadequacy of the assumptions of central forces and elastic collisions. A.

539.19

7474. MASS SPECTRA REARRANGEMENTS OF 2-PHENYL ALCOHOLS. J.A.Gilpin.
J. chem. Phys., Vol. 28, No. 3, 521-2 (March, 1958).

A comparison of the mass spectra of 0-deutero-2-phenylethanol and 0-deutero-2-phenylpropanol with those of the corresponding undeuterated alcohols yields information about the H atom rearrangements. The major rearrangement ions in the spectra of the 2-phenylalcohols involve migration of the hydroxyl hydrogens, which seems in accordance with the formation of stable structures. J.Jacobs

539.19 : 534.222.2

7475. THE DISSOCIATION OF A PURE DIATOMIC GAS BEHIND A STRONG NORMAL SHOCK WAVE. G.Jarre.
Z. angew. Math. Phys., Vol. 9b, No. 5-6, 389-403 (1958).

Generalized equations, using characteristic temperature and molar density, are derived for the relaxation of dissociation behind a normal shock wave for a homonuclear diatomic gas. Various simplifying assumptions include constant specific heat and $\gamma = 4/3$ for the diatomic molecule. Curves are plotted, and it is shown that the degree of dissociation approaches the equilibrium value exponentially. Brief numerical examples for N_2 and O_2 are given.

A.G.Gaydon

539.19 : 539.12

7476. μ-MESONIC MOLECULAR IONS AND NUCLEAR CATALYSIS. S.Cohen, D.L.Judd and R.J.Riddell, Jr.
Phys. Rev., Vol. 110, No. 6, 1471-2 (June 15, 1958).

Binding energies of bound states of μ-mesonic molecular ions $(p\mu p)^+$, $(p\mu d)^+$, $(d\mu d)^+$ are calculated, using the Born—Oppenheimer approximation as a starting point for a variational method. The scattering states are also evaluated, and curves for the energy dependence of elastic scattering cross-sections of μ-mesonic atoms on protons and deuterons are given. The authors point out the smallness of the cross-section $(d\mu) + p$ in the thermal range, indicating that one should therefore expect a kind of Ramsauer effect.

J.Lascoux

SOLID-STATE PHYSICS

539.2 : 537.312.62 : 534.321.9

7477. PROPERTIES OF MATTER. SOLIDS. R.W.Morse.
J. Acoust. Soc. Amer., Vol. 30, No. 5, 380-2 (May, 1958).

Paper read at the Acoustical Society of America symposium on "Unsolved problems in acoustics", October 1957, referring to (a) the need to study the fundamental properties under a wide range of external conditions especially at hypersound (~ 10^4 Mc/s) where sound and light wavelengths are commensurate and the phonon energy is capable of inducing quantum transitions; and (b) the possible role of ultrasonics in clarifying understanding of superconductors. H.D.Parbrook

539.2 : 539.58

7478. DYNAMICAL COMPRESSIBILITY AND EQUATION OF STATE FOR IRON UNDER HIGH PRESSURE.
L.V.Al'tshuler, K.K.Krupnikov, B.N.Ledenev, V.I.Zhuchikhin and M.I.Brazhnik.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 874-85 (1958). In Russian.

Two methods for measurement of dynamical compressibility of substances are described which are based on determination of the kinematical parameters of shock waves, that is, their velocity of propagation and the mass velocity of the substance behind the front. The adiabatics of shock compressibility of iron possessing various initial densities were determined by these methods in the pressure range from 4×10^5 to 5×10^6 atm. The compressibility curve of iron at absolute zero temperature is derived from the experimental data obtained. The curve is extrapolated to pressures at which statistical models of the atom are valid. A.

539.2

7479. ON THE LATTICE VIBRATIONS IN CUBIC IONIC CRYSTALS. S.O.Lundqvist.
Ark Fys., Vol. 12, Paper 8, 263-75 (1957).

For previous work, see Abstr. 6332 (1955). A somewhat more accurate estimate of the three-body potential is considered, giving certain correction terms to the formula for the effective charge derived earlier. The limitations of the Heitler—London method in this connection are discussed and a semi-empirical approach is suggested including also the polarization. A.

539.2 : 534.23

7480. MAGNETIC EFFECTS IN THE ATTENUATION OF TRANSVERSE ACOUSTIC WAVES BY CONDUCTION ELECTRON TRANSPORT. M.S.Steinberg.
Phys. Rev., Vol. 110, No. 3, 772-3 (May 1, 1958).

Formulae valid at low frequencies are derived for the coefficient of attenuation with three magnetic field orientations: (1) in the direction of propagation, (2) parallel to displacements, (3) perpendicular to both. In case (1) a formula valid at all frequencies is obtained and its behaviour discussed. D.M.Edwards

539.2

7481. THE SPECTRUM OF NATURAL OSCILLATIONS OF NaCl TAKING ACCOUNT OF IONIC DEFORMATION.
K.B.Tolpygo and I.H.Zaslavs'ka.
Ukrayin. fiz. Zh., Vol. 1, No. 3, 226-44 (1956). In Ukrainian, with summary ($1\frac{1}{2}$ pp.) in Russian.

Using a theory put forward by the first author for a lattice with deformable ions, a calculation is made of the natural frequencies and normalized amplitudes of oscillation of NaCl, a corresponding investigation having already been made for KCl (Trudy Fizicheskogo Instituta Akad. Nauk SSSR, Vol. 4, 71, 1953). C.R.S.Manders

539.2 : 536.631

7482. CALCULATION OF THE SPECIFIC HEAT OF THE NaCl CRYSTAL. I.H.Zaslavs'ka.
Ukrayin. fiz. Zh., Vol. 1, No. 4, 366-70 (1956). In Ukrainian, with summary ($\frac{1}{2}$p.) in Russian.

The Tolpygo crystal lattice model (preceding abstract) is taken and the specific heat of NaCl calculated for 10 different temperatures covering the range 0 to 300° K. The results are compared with those obtained experimentally by Clusius, Goldmann and Perlick (Abstr. 3131/1950) and with the theoretical data of Kellermann (Abstr. 1978/1940; 1319/1941). Agreement appears to be very satisfactory. C.R.S.Manders

539.2 : 538.114

7483. THE PROBLEM OF THE STATISTICS OF SPIN WAVES. M.S.Svirskiĭ and B.Kh.Ishmukhametov.

Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 548-50 (1957). In Russian.

It is suggested that the proper statistics is that of Bose, and not Fermi as proposed by Frank (Abstr. 6707/1957). J.M.Hough

539.2

7484. EXACT FOUNDATIONS OF THE THEORY OF SPIN WAVES. F.Bopp and E.Werner.
Z. Phys., Vol. 151, No. 1, 10-15 (1958). In German.

It is shown that for the non-relativistic many-electron problem, the exact equations are of the Bloch-type for spin waves, if spin interactions are neglected. The discussion is based on an existence theorem for functions $u(\vec{r})$ in the configuration space of the electrons, such that (1) $u(P\vec{r})$ and $u(P'\vec{r})$ corresponding to different permutations are either identical or orthogonal, and (2) the Hamiltonian operator applied to $u(\vec{r})$ gives a linear combination of the functions $u(P\vec{r})$. R.A.Newing

539.2

7485. THREE-CENTRE INTEGRALS IN IRON. M.Suffczyński. Bull. Acad. Polon. Sci. Sèr. Sci. math. astron. phys., Vol. 6, No. 3, 195-8 (1958).

Discusses the inclusion of three-centre integrals in the tight-binding method for calculating the electronic d-band structure. D.M.Edwards

539.2

7486. SOLUTION OF BOLTZMANN EQUATION FOR MULTIPLE SCATTERING OF ELECTRONS [IN FOILS]. G.Molière.
Nuovo Cimento, Vol. 7, No. 5, 720-3 (March 1, 1958).

A determination of the influence of multiple scattering of electrons inside foils is made. The Boltzmann equation governing the motion of electrons inside a plane parallel plate is reduced to an infinite set of linear equations, with the help of the folding product. The resultant infinite secular equation is rapidly convergent, enabling eigenvalues and eigenfunctions to be found by simple numerical methods. Applying the method to the diffusion differential equation, the calculated eigenvalues and eigenfunctions are compared with the results of a higher-order asymptotic treatment. The diffusion approximation proves adequate in the asymptotic domain of large thickness. M.J.Kearsley

539.2

7487. GENERALISED WKB-METHOD OF ASYMPTOTIC EXPANSION. G.Molière.
Nuovo Cimento, Vol. 7, No. 5, 724-6 (March 1, 1958).

For comparison with the numerical evaluation of the eigenvalues of the diffusion equation (see preceding abstract) a higher-order asymptotic treatment extending the procedure of Bethe, Rose and Smith (Abstr. 2597/1938) is developed and applied to the equation. A method, expressing one function asymptotically in terms of another, when both obey linear homogeneous second-order differential equations, is described, which, for exponential or trigonometric functions, reduces to the WKB-method. M.J.Kearsley

539.2

7488. ELECTRON MOBILITY IN AgCl. F.C.Brown and F.E.Dart. Phys. Rev., Vol. 108, No. 2, 281-4 (Oct. 15, 1957).

Transit-time measurements of electron mobility in AgCl have been extended to very low temperatures. Results are presented for an air-grown Bridgman crystal and for a Kyropoulos crystal of high purity. A maximum mobility of about 250 $cm^2 V^{-1} sec^{-1}$ at 80°K was found for the former and a maximum of 480 $cm^2 V^{-1} sec^{-1}$ at 55°K for the latter. It appears that imperfections strongly influence the mobility at low temperatures. At intermediate temperatures the data are in best agreement with the theory of interaction with optical modes of vibration of the lattice from which it is found that $\mu_0 = 30(e^{280/T}-1)\ cm^2 V^{-1} sec^{-1}$. This corresponds to a polaron effective mass of $m^*/m_e = 0.28$ where m_e is the free electron mass. A.

539.2 : 538.27

7489. BAND STRUCTURE OF GRAPHITE AND DE HAAS–VAN ALPHEN EFFECT. J.W.McClure.
Phys. Rev., Vol. 108, No. 3, 612-18 (Nov. 1, 1957).

The de Haas–van Alphen effect in the magnetic susceptibility of graphite is interpreted by applying the susceptibility formula for general bands of Lifschitz and Kosevich to the band model of Slonczewski. The majority electrons and holes are responsible for the two periods of oscillation of the susceptibility. The analysis yields information concerning the band structure: (1) the total band overlap is about 0.03 eV; (2) the energy difference between the two doubly degenerate bands at the corner of the Brillouin zone is about 0.025 eV; (3) γ_0 must be larger than about 1.2 eV, and (4) the relatio $\gamma_1 = 0.04\gamma_0^2$ holes approximately (where both γ's are in eV and corr pond to Wallace's notation). Calculated carrier densities are 2.4×10^{-5} per atom for electrons and 1.8×10^{-5} per atom for holes in rough agreement with estimates made from galvanomagnetic data Rough agreement with electron specific-heat data is also obtained. A

539.

7490. THEORETICAL INVESTIGATION OF THE ELECTRONIC ENERGY BAND STRUCTURE OF SOLIDS. F.Herman.
Rev. mod. Phys., Vol. 30, No. 1, 102-21 (Jan., 1958).

The many theoretical techniques that are available for studying energy band structures are described and an attempt is made to place them in proper perspective. The elements of energy-band theory are first described. It is emphasized that in the determination of the band structure of a crystal, involving the construction an solution of a set of one-electron wave-equations, the essential prob lem is the choice of the potential appearing in these equations (that is the effective interaction between an electron and the rest of the crystal). The various approximations to this effective interaction are discussed. The use of group theory and perturbation theory is described and, in particular, how a group theoretical analysis can provide an exhaustive list of the possible types of energy band struc tures. The correct type can then often be determined by interpreti particular experiments in terms of each of these. The author considers briefly each of the various approximate methods used to sol the wave equation: (a) the method of plane waves; (b) the method of orthogonalized plane waves; (c) modified plane waves; (d) augmente plane waves; (e) Bloch; (f) LCAO method of Löwdin; (g) LCAO inter polation scheme; (h) Wannier functions; (i) cellular method; (j) scat tering matrix method; (k) variation-iteration method. As illustrati examples, details of the band structure of several materials are de cribed, including: germanium (in detail), indium antimonide, aluminium, berylium, selenium and graphite. A very extensive bib liography is given. R.Bullough

539.

7491. EXPERIMENTAL INVESTIGATIONS OF THE ELECTRONI BAND STRUCTURE OF SOLIDS. B.Lax.
Rev. mod. Phys., Vol. 30, No. 1, 122-54 (Jan., 1958).

The various classes of experiment are discussed that have played a significant part in the present understanding of the band structure of many materials of current interest; in particular, experiments on the de Haas–van Alphen effect, cyclotron resonance, galvanomagnetic effect and infrared absorption, are described. Th most useful technique is the cyclotron resonance technique and the most promising is thought to be the newly discovered oscillatory magneto-absorption effect. Under the heading of cyclotron resonance, the author describes in detail microwave experiments on semi conductors and metals, and infrared cyclotron resonance. The theory of and the experimental techniques involved in using the de Haas–van Alphen effect are described and the experimental results on bismuth, arsenic, gallium and zinc are given. The experim ental results obtained using the galvomagnetic effects with germanium, silicon, bismuth and other metals are also described in detail A discussion, with particular reference to silicon, germanium and indium antimonide, of the use of infrared absorption and the oscilla tory magneto-absorption is given. R.Bullough

539.2

7492. THE THEORY OF LOCAL STATES OF AN ELECTRON IN A CRYSTAL. S.A.Moskalenko.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 61-4 (1957). In Ukrainian.

A survey, with particular reference to the case of local states of small radius. C.R.S.Mander

539.

7493. THE MICROSCOPIC THEORY OF ELECTRONIC STATES IN POLAR CRYSTALS. K.B.Tolpygo.
Ukrayin. fiz. Zh., Vol. 2, No. 3, 242-60 (1957). In Ukrainian.

A general method is developed for calculating ψ-functions and the energy of a local state with introduction into an ionic crystal of an electron or hole with a vacant lattice junction of opposite sign. For crystals possessing relatively high symmetry (NaCl, CsCl, etc the problem of determining the self-consistent state is reduced to a series of purely algebraic operators. C.R.S.Mander

539.

7494. CYCLOTRON RESONANCE IN TIN AT 9300 Mc/s. P.A.Bezuglyĭ and A.A.Galkin.
Zh. eksper. teor. Fiz., Vol. 33, No. 4(10), 1076-8 (1957).

Russian. English translation in: Soviet Physics—JETP (New ork), Vol. 6, No. 4, 831-3 (April, 1958).

Reports observation of the resonance behaviour predicted by zbel' and Kaner (Abstr. 2395/1957). The variation of surface res-tance with magnetic field resembles that found by Fawcett (Abstr. 396/1957). R.G.Chambers

539.2

495. CYCLOTRON RESONANCE IN LEAD AT 8900 Mc/s. .A.Bezuglyĭ and A.A.Galkin.
h. éksper. teor. fiz., Vol. 34, No. 1, 236-7 (1958). In Russian.

539.2 : 539.12

POSITRON ANNIHILATION IN THE NOBLE METALS.
e Abstr. 6510

539.2

496. ON THE THEORY OF THERMAL EXCITATION OF OLARONS. V.A.Moskalenko.
h. éksper. teor. Fiz., Vol. 34, No. 2, 346-54 (1958). In Russian.

The probability of a quantum transition of a polaron from the s to 2p-state caused by thermal vibrations of the lattice is comp-ed. The adiabatic form of perturbation theory is used in the calc-lations. At room and higher temperatures transition to the 2p-ate occurs in 10^{-8}-10^{-9} sec. A.

539.2 : 535.337

497. ON THE THEORY OF THE STARK EFFECT FOR XCITONS. I. G.G.Taluts and S.A.Shulyat'ev.
iz. Metallov i Metallovedenie, Vol. 5, No. 3, 550-2 (1957).
Russian.

A matrix-mechanical treatment of the interaction between the xciton and the applied electric field. J.M.Hough

539.2

498. THE PROBLEM OF DETERMINING THE LENGTH OF IFFUSION SHIFT OF EXCITONS IN MOLECULAR CRYSTALS. .D.Borysov and V.N.Vyshnevs'kyĭ.
krayin. fiz. Zh., Vol. 1, No. 4, 371-5 (1956). In Ukrainian.

Crystals of naphthalene and anthracene were illuminated by strong beam of light whose wavelength lay in the strong absorption and of these crystals. The variation of luminescence intensity ith wavelength of exciting light was then investigated for these rystals. On the basis of the results obtained, and also of a uggestion that the motion of excitons in molecular crystals is of iffusion type, the length of diffusion displacement of the excitons s estimated for anthracene to be from 0.10 to 0.15 μ and for aphthalene for 0.20 to 0.30 μ. C.R.S.Manders

539.2 : 535.328 : 535.345

499. THE EXCITON THEORY OF DISPERSION AND BSORPTION OF LIGHT. V.I.Cherepanov and V.S.Galishev.
iz. Metallov i Metallovedenie, Vol. 5, No. 3, 547-8 (1957).
n Russian.

Develops previous work (ibid., Vol. 3, 395, 1956 and Abstr. 408/1958) to give specific formulae for dispersion and absorption. J.M.Hough

539.2

500. EMISSION AND ABSORPTION OF LIGHT IN MOLECULAR RYSTALS DUE TO THE FORMATION OF LOCALIZED XCITATIONS. O.S.Davydov and A.F.Lubchenko.
krayin. fiz. Zh., Vol. 1, No. 1, 5-14 (1956). In Ukrainian, with ummary ($\frac{1}{2}$ p.) in Russian.

Using the wave-functions for a crystal system and radiation field, xpressions are derived establishing a simple connection between the ntensity of the light emitted, polarized along the axes of the Cauchy llipsoid, the refractive indices for these axes and the squares of ne cosines of the angles which determine the mean orientation of the ransition dipole moment relative to those same axes. C.R.S.Manders

539.2

501. SPECTRUM DISTRIBUTION OF THE INTENSITY OF MISSION AND ABSORPTION OF LIGHT BY MOLECULAR RYSTALS DURING FORMATION OF LOCALIZED EXCITATIONS. .S.Davydov and A.F.Lubchenko.
krayin. fiz. Zh., Vol. 1, No. 1, 15-28 (1956). In Ukrainian, with ummary ($1\frac{1}{2}$ pp.) in Russian.

Theoretical paper investigating the spectrum distribution and alculating the mean radiating life-time of a localized excitation. t is shown that the form of the absorption and emission bands here epend on temperature and the difference in behaviour at low and igh temperatures is discussed in detail. C.R.S.Manders

539.2

502. THE SHAPE OF DISPERSION CURVES IN MOLECULAR CRYSTALS WHICH CORRESPONDS TO LOCALIZED EXCITATIONS. O.S.Davydov and A.F.Lubchenko.
Ukrayin. fiz. Zh., Vol. 1, No. 2, 111-19 (1956). In Ukrainian, with Summary ($\frac{1}{2}$ p.) in Russian.

Dispersion curves of molecular crystals and their variation with temperature are computed for localized excitations. At high temperatures the curves are similar to those of a free molecule taking Doppler effect into account. At lower temperatures the curves become asymmetric about an ordinate through the maximum point of the curve and there is a displacement of the point where the curve intersects the frequency axis. For low temperatures the absorption spectrum degenerates into a series of lines like an atomic spectrum and the dispersion curve for each line has the shape of the curve $y = x/(1 + x^2)$. C.R.S.Manders

539.2 : 535.34

7503. LIGHT ABSORPTION IN MOLECULAR CRYSTALS DURING WEAK INTERACTION OF EXCITONS WITH PHONONS. O.S.Davydov and E.I.Rashba.
Ukrayin. fiz. Zh., Vol. 2, No. 3, 226-41 (1957). In Ukrainian.

The form of the absorption spectrum is considered when transitions may be accompanied by generation or absorption of one phonon. The paper discusses linear chain, 2- and 3-dimensional crystals of arbitrary structure and the law of interaction between molecules, also the width of the exciton band and its relation to boundary frequencies for lattice vibrations of these molecules. It is concluded that the separation of the background maxima in the molecular crystal spectra cannot be compared with the vibrations found for Raman dispersion — a conclusion confirmed by experiment. C.R.S.Manders

539.2

7504. EXTENSION OF THE BOGOLYUBOV— TYABLIKOV PERTURBATION THEORY METHOD TO THE NON-STATIONARY CASE. S.V.Vonsovskiĭ and V.I.Cherepanov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 97-105 (1958). In Russian.

The perturbation theory method in the secondary quantization representation developed by Bogolyubov and Tyablikov for the stationary case of a polar model of crystals is extended to the case of perturbations induced by the electromagnetic field of a light wave. The general expression for the deformed electric current density operator related to the light perturbation is derived. A possible application of the method in the theory of optical properties of crystals is indicated. A.

539.2

7505. DOMAIN CONVERSION OF MULTIDOMAIN BARIUM-TITANATE SINGLE CRYSTALS.
P.H.Fang, S.Marzullo and W.S.Brower.
Phys. Rev., Vol. 108, No. 2, 242-3 (Oct. 15, 1957).

It is found that complete domain conversion of single-crystal $BaTiO_3$ can be achieved by passing the crystal through the orthorhombic-tetragonal transition under an applied d.c. field. By using this process either complete a- or c-domain crystals can be prepared. A.

539.2

7506. CREATION OF DISLOCATIONS IN LiF CRYSTALS AT LOW STRESSES. J.J.Gilman and W.J.Johnston.
J. appl. Phys., Vol. 29, No. 1, 110-11 (Jan., 1958).

Previous experiments showed an apparently spontaneous formation of dislocation loops in LiF at stresses ~1 kg/mm^2. Reasons are given for believing that Weertman's explanation (Abstr. 401/1958) in terms of prismatic dislocations formed by vacancy condensation is wrong. A.B.Lidiard

539.2

7507. MOVEMENT OF DISLOCATION LOOPS IN LITHIUM FLUORIDE. S.Amelinckx and W.Dekeyser.
J. appl. Phys., Vol. 29, No. 6, 1000-1 (June, 1958).

Recently Gilman and Johnson produced crystals containing a single dislocation half-loop. When this was expanded by stressing the crystal, new, small loops were found to appear in the unslipped part of the glide plane. Reversing the stress resulted in the production of loops behind the contracting half loop. A mechanism is proposed here based on the idea that the method of production of the original loop (involving at one stage multiple slip) may result in a jogged dislocation, and that this is responsible for the secondary loops. For example, motion of the jogged loop can produce point defects in configurations which, by collapse of the lattice, give small prismatic dislocation loops. A.B.Lidiard

539.2 : 539.27

7508. ELECTRON INTERFEROMETRIC DEMONSTRATION OF LATTICE DEFECTS IN SINGLE CRYSTALS.
O.Rang and H.Poppa.
Naturwissenschaften, Vol. 45, No. 10, 239 (1958). In German.

Electron interference effects in superimposed single crystals were reported by one of the authors in 1953 (see Abstr. 4597/1954). Subsequent investigators have observed similar phenomena, often referred to as "moiré patterns". Examples of such patterns obtained from gold single crystals are shown; these reveal lattice defects beyond the resolution of the electron microscope. T.Mulvey

539.2

7509. THE ENERGY OF VACANCY FORMATION IN METALS AND ALLOYS. S.D.Hertsriken.
Ukrayin. fiz. Zh., Vol. 1, No. 2, 193-203 (1956). In Ukrainian, with summary (2½ pp.) in Russian.

This is surveyed at some length, and the results are given for energy of vacancy formation from expansion measurements for alloys: Ag containing 10, 20, 40, 60 and 80% Au; 100% Au; Pt+20% Ir; Ni + 10% Cr. A comparison of the results with those obtained by other methods shows a paucity of experimental data and a necessity for an investigation of the applicability of the various methods employed. C.R.S.Manders

539.2

7510. OCCURRENCE OF DISLOCATIONS IN GERMANIUM.
V.A.Zhȳdkov and L.O.Khomenko.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 65-7 (1957). In Ukrainian.

A discussion is presented of the results obtained with thermal treatments carried out at various temperatures and for various lengths of time on specimens of Ge 10-15 mm thick, 40-60 mm square and weighing 30-50 gm. Photographs of some linear dislocations are given. C.R.S.Manders

539.2

7511. DETERMINATION OF THE ENERGY OF FORMATION OF VACANCIES AND THEIR RELATIVE NUMBER IN PURE METALS.
S.D.Hertsriken and B.F.Slyusar.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 376-9 (1957). In Ukrainian.

Gives the results of some measurements on very pure (0.005-0.01% impurity) Au, Cu, Al, Pb, Sn, and Zn. C.R.S.Manders

539.2

7512. ON THE DEFECTS IN THE CRYSTALLINE LATTICE OF N-TYPE GERMANIUM.
V.S.Vavilov, L.S.Smirnov, A.V.Spitsȳn, V.M.Patskevich and G.N.Galkin.
Zh. tekh. Fiz., Vol. 28, No. 5, 960-1 (1958). In Russian.

A numerical error in a previous paper (Abstr. 2824/1957) is corrected. There is now an order-of-magnitude discrepancy between the theoretically predicted and experimentally observed values of the cross-sections for the formation of Frenkel defects in n-type Ge bombarded with 0.4 - 1.0 MeV electrons (a 0.5 MeV threshold energy is assumed in the theory). K.F.Hulme

539.2

7513. COLOUR CENTRES IN CRYSTALLINE KCl AND IN KCl WITH Ag* IMPURITY. N.G.Politov.
Radiotekhnika i Elektronika, Vol. 2, No. 3, 291-5 (1957). In Russian.

An analysis is given of experimental absorbtion spectra of KCl and KCl—Ag irradiated with X-rays and ultraviolet light. S.F.Edwards

539.2 : 537.311.33

7514. INFLUENCE OF CRYSTAL ORIENTATION ON THE SURFACE BEHAVIOR OF InSb.
M.C.Lavine, A.J.Rosenberg and H.C.Gatos.
J. appl. Phys., Vol. 29, No. 7, 1131-2 (July, 1958).

Faces perpendicular to the <111> direction in InSb may have a different chemical structure due to one indium atom being bonded to three internal antimony atoms, and vice versa. Crystals cut to reveal {111} or {$\bar{1}\bar{1}\bar{1}$} planes were subjected to anodic oxidation, air oxidation at 350°C, and to acid etching. The results confirm that chemical reactivity of InSb surfaces is markedly affected by crystallographic orientation. C.A.Hogarth

539.2

7515. SCATTERING OF X-RAYS AND THERMAL NEUTRONS BY SINGLE-COMPONENT CRYSTALS NEAR PHASE-TRANSITION POINTS OF THE SECOND KIND. M.A.Krivoglaz.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 405-11 (1958). In Russian.

Geometric distortions of the crystal lattice connected with fluctuations of internal parameters characterizing long-range order are taken into account explicitly. The general case is considered when long-range order is characterized not by one but by several parameters. Near phase-transition points of the second kind singularities can be observed in the distribution of diffuse scattering in the neighbourhood of superstructural reflections as well as near the main regular reflections. The nature of the dependence of the scattering intensity on temperature and on the position in the space of the reciprocal lattice significantly depends on the crystal symmetry. Ferroelectric crystals are considered in greater detail. In this case parameters determining the intensity of diffuse scattering near nodes in the space of the reciprocal lattice can be determined by independent experiments. A.

539.2

7516. PARAMAGNETIC RELAXATION AT VERY LOW TEMPERATURES.
J.A.Giordmaine, L.E.Alsop, F.R.Nash and C.H.Townes.
Phys. Rev., Vol. 109, No. 2, 302-11 (Jan. 15, 1958).

A series of experiments using paramagnetic resonance at microwave frequencies and in the 1-4°K temperature range on $Gd_2Mg_3(NO_3)_{12}.24H_2O$, $K_3Cr(CN)_6$, and $Cu(NH_4)_2(SO_4)_2.6H_2O$ indicate the following characteristics for their relaxation: (1) It is the lattice-bath relaxation which limits the total rate of relaxation. (2) The spin—lattice relaxation time is several orders of magnitude smaller than the normally observed values of T_1. (3) Breadth of the lattice modes is very much larger than the width of the resonances in dilute crystals, and in particular for 1% paramagnetic concentration of the Cu salt, the breadth is several hundreds of megacycles/second. (4) Breadth of the lattice modes increases with increasing concentration of paramagnetic centres. (5) Two nearby resonances are rapidly brought to the same effective temperature by exchange of energy through the lattice modes. (6) The relaxation time T_1 is dependent on crystal size. Some consequences of these results are also discussed. A.

539.2 : 538.561

7517. ELECTRON SPIN AND PHONON EQUILIBRIUM IN MASERS.
N.Bloembergen.
Phys. Rev., Vol. 109, No. 6, 2209-10 (March 15, 1958).

The paper is concerned with an explanation of the slow heat exchange between the spin system of salts like $KCo(Cr)-CN_6$ used for three level maser operation, and the helium bath. It is argued that successful maser operation proves that there must be many more spins in the upper state of the pair responsible for amplification than in the lower. If the heat contact of the spin system with phonons was good, the population of the two levels would at best be equal. Having shown this, the author rejects the explanation brought forward by Townes and coworkers (preceding abstract) according to which the heat exchange is slow owing to poor contact between lattice vibrations and the heat bath. H.Motz

539.2

7518. MEASUREMENT OF THE LINE SHAPES AND RELAXATION TIMES IN PARAMAGNETIC ELECTRON RESONANCE AT LOW TEMPERATURES AND WEAK MAGNETIC FIELDS.
E. de Wolf.
Verhandl. K. Vlaamse Acad. Wetensch., No. 55, 96 pp. (1957).
In Dutch.

Reports results of measurements on diphenyl picryl hydrazil and carbon between 1.5°K and room temperature. E.P.Wohlfarth

539.2

7519. TEMPERATURE DEPENDENCE OF PARAMAGNETIC RESONANCE ABSORPTION OF CENTIMETRE WAVES.
S.G.Salikhov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 39-44 (1958). In Russian.

Paramagnetic resonance absorption in some paramagnetic salts at centimetre waves was studied in the temperature range from 90 to 500°K for the following compounds: $CrCl_3$, MnF_2, MnO, CuF_2 and $Cr(OH)_3$. It is shown that in $CrCl_3$ and CuF_2 the line-width does not depend on the temperature and the intensity of the effect varies in accord with the Curie—Wiess law. The temperature dependence of the effect in MnF_2 and MnO is more complex and this indicates the existence of residual antiferromagnetism in these compounds at temperatures above the Curie point. A.

539.2

7520. THE EFFECT OF THERMAL CONDUCTIVITY IN THE PHENOMENOLOGICAL THEORY OF PARAMAGNETIC RELAXATION. N.K.Belousova.

h. éksper. teor. Fiz., Vol. 34, No. 2, 371-8 (1958). In Russian.

The effect of thermal conductivity of the lattice is taken into ccount in the framework of the phenomenological theory of the aramagnetic relaxation of solids in parallel fields; the boundary onditions on the surface of the spherical specimen are assumed to e isothermal. The effect is found to be important at low temper- tures in the liquid-helium region. A.

539.2 : 534.232

PARAMAGNETIC CENTRES AS DETECTORS OF ULTRASONIC ADIATION AT MICROWAVE FREQUENCIES. See Abstr. 6771

539.2 : 539.14

521. SPIN–LATTICE RELAXATION RESONANCES IN SOLIDS. .S.Gutowsky and D.E.Woessner.
hys. Rev. Letters, Vol. 1, No. 1, 6-8 (July 1, 1958).

When a single crystal with two types of nuclei, one with $I = \frac{1}{2}$ nd the other with $I > \frac{1}{2}$, is placed in a magnetic field a number of esonances can occur. By adjusting the magnitude and direction of e magnetic field it is possible to make resonances of different uclei coincide. The example of protons and Cl^{35} is discussed; when e resonances coincide proton-chlorine spin exchange can occur. he quadrupolar coupling of chlorine spins with the lattice is much ronger than the magnetic coupling, hence the coincidence of reson- nces reduces the proton T_1 by several orders of magnitude. This as been confirmed on a polycrystalline substance when the proton , could be reduced from 10^4 to 2.5 sec. This relaxation mechanism ay be useful in a serial storage memory device with both storage nd erasure times controllable by an external magnetic field; and three level nuclear quadrupole masers by enhancing stimulated nission. D.Walsh

539.21 : 535.557

522. BIREFRINGENCE IN NEUTRON-IRRADIATED BORON LASS. C.Mylonas, R.Truell and P.W.Levy.
. appl. Phys., Vol. 29, No. 5, 864-5 (May, 1958).

Damage from the $B^{10}(n,\alpha)Li^7$ reactions results in a contraction the glass network. J.Adam

539.21 : 537.534.9

523. IONIC BOMBARDMENT CLEANING OF GLASS. L.Holland.
ature (London), Vol. 181, 1451-2 (May 24, 1958).

Prolonged electron bombardment in a glow discharge was found lead to a hard, optically absorbing, film, which was traced to the ecomposition of hydrocarbon contaminants. Positive ion bombard- ent, however, resulted in a clean glass surface. An electrode ystem is described in which the electron stream reaching the object reduced relative to the ion stream. K.W.Plessner

539.21

524. ANNEALING OF ELECTRON BOMBARDMENT DAMAGE N SILICON CRYSTALS. G.Bemski and W.M.Augustyniak.
hys. Rev., Vol. 108, No. 3, 645-8 (Nov. 1, 1957).

Silicon crystals were bombarded at room temperature with lectrons of 700 keV from a Van de Graaff accelerator. The anneal- g of the bombardment damage was studied between 200°C and 00°C by observing the recovery of the minority-carrier lifetime. he annealing was found to proceed with an activation energy of 3 eV. This is interpreted as being the activation energy associated ith the lattice jump frequency. The kinetics of the annealing are entical in most p-type and n-type crystals. A second-order process as identified toward the end of the annealing. Evidence is given at crystalline defects can influence the annealing kinetics. A.

539.21

525. EVIDENCE FOR INTERSTITIALS IN LOW-TEMPERATURE -RAY IRRADIATED LiF. D.A.Wiegand and R.Smoluchowski.
hys. Rev., Vol. 110, No. 4, 991-2 (May 15, 1958).

A photoelastic technique was used to measure the volume xpansion of LiF irradiated at 94° K. The expansion was propor- onal to time of irradiation up to relative expansions of 10^{-4}. -band absorption also increased linearly with dose, but a band at 400 A saturated quickly. Substantial annealing occurred on arming the crystal to 160° K: the 3400 A band annealed out ntirely, three quarters of the volume expansion disappeared while he F-band intensity decreased by only one third. Further measure- ents indicated that the F-band decrease was associated with loss F electrons without any appreciable decrease in the number of egative ion vacancies. Some possible mechanisms are discussed. A.B.Lidiard

539.21

526. EFFECT OF ELECTRON BOMBARDMENT ON THIN FILMS F SODIUM CHLORIDE. A.Gel'berg and N.Krol'toru.
Zh. tekh. Fiz., Vol. 28, No. 4, 755-8 (1958). In Russian.

Electron bombardment of a NaCl film results in changes in the structure of its surface. This is partly due to an increase in temperature during irradiation. The changes are illustrated by photomicrographs. Z.Krasucki

539.21 : 537.312.5

PHOTOCONDUCTIVITY OF ANTHRACENE. THE EFFECT OF NEUTRON BOMBARDMENT. See Abstr. 7011

STRUCTURE OF SOLIDS

539.213 : 533.7

7527. CALCULATION OF ATOMIC DISTRIBUTION CURVES FOR VARIOUS STRUCTURE MODELS. F.Herre and H.Richter.
Z. Phys., Vol. 150, No. 2, 149-61 (1958). In German.

Radial distributions and their Fourier transforms are considered for diatomic and polyatomic gases, and for amorphous materials in which every atom may not have the same distribution of atoms around it as every other atom (e.g. finely divided carbon). A.R.Stokes

539.214 : 537.311.33

7528. LIGHT-INDUCED PLASTICITY IN SEMICONDUCTORS. G.C.Kuczynski and R.F.Hochman.
Phys. Rev., Vol. 108, No. 4, 946-8 (Nov. 15, 1957).

It was found that light of wavelength between 2.0 and 4.0 μ, or shorter than 0.4 μ, decreases the hardness of the surface layer of n-type germanium by 10 to 60%. The softened layer extends to a depth of one to two microns. A similar but less intense effect was observed in p-type germanium and n-type InSb and InAs. On the other hand, p-type silicon seems to soften to a greater extent than germanium. The effect is proportional to light intensity and is affected by surface preparation. A.

539.217

7529. INVESTIGATION OF DIFFUSION OF THE CONSTITUENTS OF Tl_2Se BY THE METHOD OF LABELLED ATOMS. G.A.Akhundov and G.B.Abdullaev.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 2, 267 (1958). In Russian.

Radioactive nuclides Tl^{204} and Se^{75} were deposited by electrolysis on one end of Tl_2Se cylinders about 12 mm long and 6 mm in dia. The coefficients of diffusion were determined from the formula $I(x,t) = ce^{-x^2/Dt}$, where I is the number of pulses/min; x, the depth of penetration; t, the time of diffusion; c, a constant. The coefficient of diffusion for Tl was $1.17 \times 10^{-3}e^{-0.61/kT}$ and that for Se, $2.25 \times 10^{-5}e^{-0.58/kT}$ cm²/sec. F.Lachman

539.217

7530. NONDIFFUSIBILITY OF OXYGEN THROUGH PLATINUM. F.J.Norton.
J. appl. Phys., Vol. 29, No. 7, 1122 (July, 1958).

An attempt was made to measure the permeation of O_2 through Pt at 1425°C using a mass spectrometer technique. The rate was less than 2×10^{-11} cm of gas per sec per cm² of Pt area per mm of Pt thickness per atmosphere pressure difference. A.B.Lidiard

539.217

7531. SELF-DIFFUSION OF OXYGEN IN URANIUM DIOXIDE. A.B.Auskern and J.Belle.
J. chem. Phys., Vol. 28, No. 1, 171-2 (Jan., 1958).

Solid–gas isotopic exchange of O^{18} was used to measure the self-diffusion coefficient of oxygen in nearly stoichiometric UO_2 in CO_2 at temperatures between 450° and 600°C. The value of the activation energy for this diffusion (29.7 kcal/mole) is in fair agreement with that obtained from kinetic studies. G.I.W.Llewelyn

539.217

7532. NON-STATIONARY DIFFUSION IN STRATIFIED MEDIA. W.Wild.
Z. angew. Phys., Vol. 9, No. 1, 38-43 (Jan., 1957). In German.

Solution of the problem of non-stationary linear diffusion in two bounded stratified media of differing diffusion constant under the condition of zero diffusion flux at the external boundaries, for short and for long diffusion times. A method for the determination of the diffusion constants by means of the measurement of the radioactivity of a tracer is discussed. H.London

539.217

7533. THE DIFFUSION OF ANTIMONY IN ANTIMONY-DOPED GERMANIUM. B.I.Boltaks, V.M.Prokhorova and L.I.Novozhilova.
Zh. tekh. Fiz., Vol. 28, No. 5, 990-5 (1958). In Russian.

The diffusion coefficients, D, were determined in Ge doped with (inactive) Sb at four different concentrations — 1.2×10^{15}, 7.7×10^{15} 4.8×10^{17}, and 1.5×10^{18} atoms/cm^3 — for temperatures 650-920°C. The diffusing species was radioactive Sb^{124} which was evaporated onto the surfaces of the specimens. The results are presented in graphs and tables; for each Sb concentration they fitted the usual relation $D = Do \exp(- E/kT)$. The results are discussed in terms of the various theories on Do and E. K.F.Hulme

539.217

7534. ON THE ANOMALOUS SPEED OF DIFFUSION OF SOME ELEMENTS IN GERMANIUM. B.I.Boltaks.
Zh. tekh. Fiz., Vol. 28, No. 5, 996-8 (1958). In Russian.

It is pointed out that the diffusion coefficients, D, and solubilities, S, of impurities in Ge show no correlation with tetrahedral covalent radii. It is noted, however, that S is large and D small for elements of groups III and V, whereas S is small and D large for elements of Groups I and VIII. Such a correlation of S and D (which is also found for impurities in metals) arises from the fact that the binding energy of an impurity atom to a substitutional lattice site determines both S and D. It is suggested that in Ge, considering impurities of similar electronegativities, if both s and p electrons are present in the outer electronic shells of an impurity atom (so that sp^3 bonds can be formed), S will be larger and D smaller than if either s or p electrons are not present. This suggestion is supported by the observation that elements of Groups III and V have both s and p electrons in their outer shells, whereas elements of Groups I and VIII have no p electrons. K.F.Hulme

539.217

7535. EFFECT OF THE ELECTRICAL FIELD ON THE DIFFUSION OF ANTIMONY IN ROCKSALT CRYSTALS.
B.I.Boltaks and I.I.Sozinov.
Zh. tekh. Fiz., Vol. 28, No. 5, 1012-18 (1958). In Russian.

The experiments were conducted with pure NaCl monocrystals after preliminary annealing, using Sb labelled with Sb^{124}. The distribution of the diffused Sb was determined by radioactive analysis of thin (20-30 μ) layers removed with thin emery paper. In the authors' experiments the electric field caused an anode shift of the maximum of concentration curves at the boundary of two specimens. It was found that Sb diffuses in NaCl as Sb^{3-}. It was also shown that the temperature dependence of the diffusion coefficient is expressed by the equation $D_{Sb \rightarrow NaCl} = 0.076 \exp(-1.8\ eV/kT)\ cm^2/sec$. A tentative diffusion mechanism is suggested. F.Lachman

539.217 : 537.226.31

DIELECTRIC LOSSES IN CRYSTAL HYDRATES AND THEIR RELATION TO DIFFUSION PHENOMENA. See Abstr. 6948

539.217 : 537.311.33

GOLD ON SILICON SURFACES. EFFECT OF HEAT TREATMENT. See Abstr. 6994

539.219 : 539.234

7536. CONTRIBUTION TO THE STUDY OF COPPER–BERYLLIUM ALLOYS. A.Viswanathan.
J. Rech. Cent. Nat. Rech. Sci., No. 37, 303-18 (Dec., 1956). In French.

The influence of experimental conditions and of the thickness of metallic films obtained by evaporation under vacuum on their crystal structure is examined. The three phases (α, γ, δ) indicated on an equilibrium diagram have been identified. The film structure depends on the thickness of the film. Thin films (~ 100 A) show a dissimulation of beryllium which reappears after heat treatment. This effect is studied by observing the variation in the relative intensity of electron diffraction images due to the different phases rich in beryllium. The variation of the cell structure parameter with film thickness demonstrates the dissolution of beryllium in the γ phase. W.Bardsley

539.219

7537. ANOMALOUS VARIATION OF BAND GAP WITH COMPOSITION IN ZINE SULFO- AND SELENO-TELLURIDES.
S.Larach, R.E.Shrader and C.F.Stocker.
Phys. Rev., Vol. 108, No. 3, 587-9 (Nov. 1, 1957).

A monotonic variation of band gap with composition occurs for many binary solid solutions. Of some Group II-Group VI systems, ZnS–ZnSe shows this type of variation of band gap with composition, whereas ZnSe–ZnTe, ZnS–ZnTe show an anomalous minimum in a plot of band gap versus composition of the solid solution. A.

539.219 : 539.26 : 539.27

7538. THEORY OF DIFFUSE SCATTERING OF X-RAYS AND THERMAL NEUTRONS IN SOLID SOLUTIONS. III. ACCOUNT OF GEOMETRICAL DISTORTIONS OF THE LATTICE. M.A.Krivoglaz.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 204-18 (1958). In Russian.

For Pt II see Abstr. 2679/1958. Scattering of X-rays and thermal neutrons in binary solutions of arbitrary composition and with arbitrary values of the short and long-range parameters is considered. Anisotropy of the crystal and its atomic structure are taken into account explicitly. The particular cases of ideal, dilute, almost completely ordered solutions and also of solutions located near the critical point on the decay curve or near phase transition points of the second kind are investigated. The diffuse scattering intensity distribution in a Cu_3Au solution calculated without making use of the theoretical parameters satisfactorily agrees with the experimental distribution. A.

539.22 : 539.27

7539. THE THIN CRYSTALLINE STRUCTURE OF CERTAIN Ni-ALLOYS. V.H.Chornyĭ.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 73-5 (1957). In Ukrainian.

Reports on three specimens containing 80% Ni, 19.5% Cr, 0.1-1.24% Ti, 0.16-2% Al, 0.3% C. At temperatures ranging from 400° to 800° C measurements were made on Rockwell hardness, together with X-ray determinations of $\Delta a/a$ and of the dimensions of the regions of coherent scattering. The data is tabulated. C.R.S.Manders

539.23

7540. SPUTTERING YIELDS FOR NORMALLY INCIDENT Hg^+-ION BOMBARDMENT AT LOW ION ENERGY. G.K.Wehner.
Phys. Rev., Vol. 108, No. 1, 35-45 (Oct. 1, 1957).

Sputtering yields for 26 metals under normally incident Hg^+ ion bombardment were measured in the energy range from 30 to 400 eV. The targets were immersed like large negative Langmuir probes in a low-pressure (1μ) Hg plasma of high density (ion current densities up to 15 mA/cm^2). Absolute yield values were obtained by measuring the weight loss from the target; relative values by measuring the speed with which sputtered material is deposited on a movable glass ribbon collector. The yields (atoms/ion) are essentially independent of gas pressure, target temperature (above 300°C) and ion current density and rise proportionally with the ion energy. The highest yields were obtained with Cu, Ag, and Au; the lowest with V, Zr, Nb, Si, and C. Metals within one crystal system behave similarly in every respect (same atom-ejection patterns, same etch features) when they are bombarded with such energies that the yield becomes equal. These comparable ion energies turn out to be proportional (with the crystal system determining the proportionality factor) to H/μ_m, where H = heat of sublimation and μ_m the momentum transfer factor $m_2/(m_1 + m_2)$. A.

539.231 : 537.311.31 : 538.221

MAGNETIC, ELECTRICAL AND ELECTRON-OPTICAL INVESTIGATIONS ON THE THERMAL CHANGE IN SPUTTERED NICKEL FILMS. See Abstr. 7174

539.23

7541. STRUCTURE OF THIN Sb_2S_3 FILMS OBTAINED BY SUBLIMATION IN AN ATMOSPHERE OF NITROGEN AT PRESSURES BELOW 4 mm Hg. A.M.Reshetnikov.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 1, 75-8 (1958). In Russian.

The author found that Sb_2S_3 films prepared in a nitrogen atmosphere at 4 or 2 mm Hg have a coarse loose structure, as if they consisted of small flakes. At 1 mm Hg the flakes are much smaller; when irradiated with an electron beam, some flakes are transformed very quickly into drop-like particles consisting of polycrystals. At 0.5 mm Hg and less, smooth films are obtained, which acquire crystalline structure when irradiated with electrons; at the same time cracks appear in the films. A tentative explanation of these phenomena is given. F.Lachman

539.234 : 537.311.3

7542. A STUDY OF THIN LAYERS OF CHANGING COMPOSITION IN THE SYSTEM INDIUM–ANTIMONY. G.A.Kurov and Z.G.Pinsker
Zh. tekh. Fiz., Vol. 28, No. 1, 29-34 (1958). In Russian.

Layers 1-6 μ thick were obtained by simultaneous evaporation under vacuum from independent sources of In and of Sb on to glass strips at room temperature. Due to the geometrical arrangement of sources and strip, the chemical composition of the deposit along a strip changed. The thermoelectric force, α, and the electrical resistance, R, were measured at various points along the strip before and after a 2 hr anneal at ~ 110°C. Electron diffraction photographs are presented; they show the presence of amorphous Sb at the Sb-rich ends of the strips, hexagonal and cubic InSb at the centres, and metallic In at the other ends. Both α and R had maxima at the composition InSb. For the InSb portions the weak temperature dependence of R

(80-420°K) indicated that the material was extrinsic at these temperatures. The Hall mobility of holes in the layers (which were all p-type) was low (~ 8 $cm^2 V^{-1} sec^{-1}$). K.F.Hulme

539.234

7543. REPLY TO G.A.KUROV'S LETTER REGARDING THE PAPER ON "THE STRUCTURE AND PROPERTIES OF INDIUM ANTIMONIDE FILMS PREPARED BY EVAPORATION IN VACUO". I.D.Konozenko and R.M.Khaĭkina.
Zh. tekh. Fiz., Vol. 28, No. 4, 789-91 (1958). In Russian.
Evidence is produced to disprove Kurov's allegation (Abstr. 2680/1958). M.H.Sloboda

539.234 : 537.311.33

THE STRUCTURE AND ELECTRICAL PROPERTIES OF THIN LAYERS OF InSb. See Abstr. 6992

539.26 : 539.4.016

7544. DOUBLE REFLECTION AS THE CAUSE OF SMALL-ANGLE X-RAY SCATTERING BY DEFORMED METALS. V.Gerold and H.Fricke.
Naturwissenschaften, Vol. 45, No. 12, 281-2 (1958). In German.
The idea of double Bragg reflection is used to explain low-angle streaks observed on diffraction photographs of cold-rolled copper. A.R.Stokes

539.26

7545. METHOD FOR THE DETECTION OF DISLOCATIONS IN SILICON BY X-RAY EXTINCTION CONTRAST. J.B.Newkirk.
Phys. Rev., Vol. 110, No. 6, 1465-6 (June 15, 1958).
The Berg—Barrett method of X-ray diffraction microscopy [C.S.Barrett, Transactions of the American Institute of Mining (and Metallurgical) Engineers, Vol. 161, 15, 1945] gives images which show the positions of individual screw dislocations emerging from the polished surface of a silicon crystal. The method is non-destructive of the specimen as a whole as well as of the dislocations themselves, since they do not have to be decorated. The positions of the dislocations are found with respect to the specific topography of the surface and the direction of the Burgers vectors can be determined by proper choice of the X-ray reflections which form the image. The exposure time is of the order of 40 min for images formed by the $02\bar{2}$ reflection of Cr Kα radiation, with the specimen 13 cm from the target of a tube operated at 40 kV and 20 mA. V.E.Cosslett

539.26

7546. SUBGRAIN STRUCTURE IN AN Fe—Si CRYSTAL AS SEEN BY X-RAY EXTINCTION CONTRAST. J.B.Newkirk.
J. appl. Phys., Vol. 29, No. 6, 995-8 (June, 1958).
The method of the preceding abstract was also applied to the study of subgrain structure in a single crystal of Fe + 3¼% Si. The relative orientation of subgrains may be roughly determined, and imperfections are to be seen within the polygonized regions themselves. Interpretation is aided if the X-ray diffraction photographs are taken in conjunction with the rocking curve of the specimen. A linear resolution of about 10 μ is obtained. V.E.Cosslett

539.26 : 539.371

7547. CALCULATIONS OF X-RAY INTENSITIES FOR A MODEL POLYCRYSTALLINE MATERIAL IN SIMPLE EXTENSION. M.F.Culpin and K.W.Kemp.
Proc. Phys. Soc., Vol. 72, Pt 1, 137-9 (July, 1958).
Numerical calculations were made from the formula derived by the authors (Abstr. 2724/1957) for the distribution of diffracted intensity round a Debye—Scherrer ring. A.R.Stokes

539.27 : 537.521

7548. THE SELF-MAINTAINING ELECTRIC GAS DISCHARGE IN A MAGNETIC FIELD AS AN AID IN ELECTRON MICROSCOPE SPECIMEN PREPARATION TECHNIQUE. R.Haefer and A.A.Mohamed.
Acta phys. Austriaca, Vol. 11, No. 2, 221-31 (1957). In German.
By placing an electron microscope specimen in a gas discharge a replica coating of either carbon, silicon monoxide, or boron can be obtained according to the filling gas used. Examples of the method in electron microscopy are given. A.E.I. Research Laboratory

539.27

7549. SUMMARIZED PROCEEDINGS OF A CONFERENCE ON ELECTRON MICROSCOPY — BANGOR, SEPTEMBER 1957. H.W.Emerton.
Brit. J. appl. Phys., Vol. 9, No. 8, 306-12, 319-22 (Aug., 1958).
The annual conference of the Electron Microscopy Group of The Institute of Physics was held in the Department of Botany, University College of North Wales, Bangor, from 10 to 12 September, 1957. The papers presented, and discussion on them, are summarzed in this report. A.

539.27

7550. CARBON SHADOWING FILMS USED IN ELECTRON MICROSCOPY. A.Oberlin and C.Tchoubar.
C.R. Acad. Sci. (Paris), Vol. 246, No. 24, 3329-32 (June 16, 1958). In French.
Shadowing an object with a metal film for electron microscopy increases the contrast but reduces the resolution because of granulation of the metal. The authors have found that they obtain better results by replacing the metal film by one of carbon. A.E.I.Research Laboratory

539.27

7551. THE FINE STRUCTURE OF THE FILMS OF A NUMBER OF SHADOWING METALS OBSERVED UNDER HIGH RESOLUTION ELECTRON MICROSCOPE. S.N.Chatterjee.
Naturwissenschaften, Vol. 45, No. 5, 106-7 (1958).
A study is made of the particle size in evaporated metal films similar to those used for shadowing specimens for the electron microscope. It is concluded that uranium gives the best results but palladium is more convenient material for routine purposes. A.E.I. Research Laboratory

539.27 : 535.826

7552. A METHOD FOR THE SELECTION AND PREPARATION OF A PARTICULAR AREA IN THE OPTICAL MICROSCOPE FOR [SUBSEQUENT] ELECTRON MICROSCOPE INVESTIGATIONS. R.Krause.
Z. wiss. Mikr., Vol. 63, No. 8, 495-8 (July, 1958). In German.
An attachment for the optical microscope is described that enables an electron microscope grid to be placed accurately on a specimen that has previously been coated with a replicating film. An adjustable knife is used to cut out the required area of film for subsequent examination in the electron microscope. A.E.I. Research Laboratory

ELASTICITY. STRENGTH. RHEOLOGY

539.313

7553. THERMODYNAMIC THEORY OF THE [ELASTIC] RELAXATION PROCESSES. T.D.Shermergor.
Zh. tekh. Fiz., Vol. 28, No. 3, 647-54 (1958). In Russian.
An extension of Hooke's law, taking into account the time of deformation, is formulated by calculating the stress and deformation tensors for a homogeneous isotropic body. The method of thermodynamics of non-equilibrium states due to Leontovich (Zh. éksper. teor. Fiz., Vol. 8, 244, 1938) is used in the calculations and the results are correlated with the expressions based on Bolzmann's principle of superposition in creep and relaxation. M.H.Sloboda

539.32 : 620.172.222 : 621.317.39

7554. A "SUPER-ELASTIC" SINGLE CRYSTAL CALIBRATION BAR. W.A.Rachinger.
Brit. J. appl. Phys., Vol. 9, No. 6, 250-2 (June, 1958).
Elastic strains of up to 4% can be attained in a copper—aluminium—nickel alloy in the form of a single crystal suitably heat treated. The high elasticity is due to a reversible martensite transformation induced by stressing. The methods of production and heat treatment of large crystals are described, together with details of mechanical properties. The alloy can be machined by conventional methods. Suggestions are made for the development of other super-elastic alloys. A.

539.32 : 548

7555. CRYSTAL STABILITY AND ELASTIC CONSTANTS. G.A.Alers and J.R.Neighbours.
J. appl. Phys., Vol. 28, No. 12, 1514 (Dec., 1957).
There are certain general relationships between the elastic constants of a crystal lattice if it is to remain stable. Some of these are described and an examination of published data on crystal constants reveals that the generally accepted value of s_{11} for gold of 20.3×10^{-13} cm^2/dyne is probably incorrect and that it should be 23.3×10^{-13} cm^4/dyne. H.J.H.Starks

539.32

7556. AN INVESTIGATION OF THE DYNAMIC MECHANICAL PROPERTIES OF GLASSY POLYMERS BY THE COMPOSITE OSCILLATOR METHOD. K.Yamamoto and Y.Wada.
J. Phys. Soc. Japan, Vol. 12, No. 4, 374-8 (April, 1957).

The dynamic Young's modulus and loss factor were determined by the composite oscillator method for several glassy polymers: phenol resin, polymethyl methacrylate, polystyrene, Nylon-6 and polyester, in the temperature from -70° to $+90^{\circ}$ C at frequencies 50, 100 and 200 kc/s. The loss factor curve of polymethyl methacrylate shows an anomaly at $\sim -20^{\circ}$ C which is concluded to be due to the γ-transition, the activation energy being estimated as 7 kcal/mole. The moisture dependence of this transition is also shown and the molecular process involved is hypothetically proposed. For polyethylene a peak of loss factor was observed at 10° C. A procedure to eliminate the false attenuation peaks observed in applying the composite oscillator method to high polymers is described. A.

539.32

7557. ON THE RECOVERY OF INTERNAL FRICTION AFTER DEFORMATION. B.Rothenstein.
Naturwissenschaften, Vol. 45, No. 10, 237 (1958). In German.

The variation of internal friction (measured by imposing a slow torsional oscillation of very small amplitude) with the intensity of an applied 50 c/s alternating magnetic field was measured at room temperature in a newly-mounted annealed Ni wire of high purity; and the measurements were repeated after a 24 hour interval. The increase in the internal-friction peak with the lapse of time is correlated with the decrease in internal stresses, and hence with the gradual fixing of the free dislocations created in the process of mounting the wire. J.G.Oldroyd

539.32 : 537.228.1 : 537.226.2

ELASTIC PROPERTIES OF SINGLE CRYSTAL BENZOPHENONE. See Abstr. 5860

539.32 : 534.23

YOUNG'S MODULUS OF YTTRIUM IRON GARNET. See Abstr. 6758

539.37

7558. THE MECHANICAL PROPERTIES OF ICE. I. THE PLASTIC PROPERTIES OF ICE. J.W.Glen.
Advances in Phys., Vol. 7, 254-65 (April, 1958).

This paper consists of four sections in which the plastic deformation of ice single crystals, the plastic deformation of polycrystalline ice, the evidence on the plastic properties of ice from measurements on glaciers, and the fracture strength of ice are respectively dealt with. In the first section, observations by various investigators on the geometry of the deformation, the creep curve and hardness of ice crystals, and the effect of uniaxial compression and hydrostatic pressure on the deformation are briefly reviewed and discussed, and in the second, the creep curve, the relation between creep rate and stress and between creep rate and temperature, and the elastic after-effect are similarly treated for polycrystalline ice. Unpublished work by Steinemann on the effect of uniaxial compression and hydrostatic pressure on the deformation of polycrystalline ice is very briefly discussed. S.Weintroub

539.37

7559. THE MECHANICAL PROPERTIES OF ICE. II. THE ELASTIC CONSTANTS AND MECHANICAL RELAXATION OF SINGLE CRYSTAL ICE. R.W.B.Stephens.
Advances in Phys., Vol. 7, 266-75 (April, 1958).

The various theoretical and experimental determinations are reviewed. Tables are given of the numerical values of the constants at -16°C, and as a function of temperature between -25°C and -2°C. A theoretical analysis of the relaxation (due to Bass) is included. S.Weintroub

539.37

7560. DYNAMIC PROPERTIES OF RESILIENT MATERIALS: CONSTITUTIVE EQUATIONS. J.E.Adkins.
Phil. Trans. A, Vol. 250, No. 985, 519-41 (1958).

Constitutive equations are formulated for a class of resilient materials for which the stress distribution at any instant is assumed to depend both upon the deformation and upon the time rates of variation of the tensors defining it. Particular attention is given to aeolotropic bodies, the stress deformation relations for orthotropic and transversely isotropic materials being put in forms which exhibit the symmetry properties of the material. In the discussion of symmetry properties, attention is confined to the case where the stress tensor is a polynomial function of two only of the kinematic tensors. Convected coordinate systems are employed in the development of the theory, but the method of transformation of the equations to a fixed frame of reference is also given. The modifications which are required for materials exhibiting curvilinear aeolotropy are briefly indicated, and some discussion is included of the manner in which certain types of geometrical constraint can be accounted for in the stress-deformation relations. A.

539.371 : 539.217

7561. ANALYSIS OF DIFFUSION IN MEDIA UNDERGOING DEFORMATION. H.Fara and R.W.Balluffi.
J. appl. Phys., Vol. 29, No. 7, 1133-4 (July, 1958).

A solution is obtained for the problem of self-diffusion into a rectangular parallelepiped that is being homogeneously deformed at a constant strain-rate and where the specimen surfaces are principal planes of deformation. D.M.Edwards

539.371 : 539.26

A MODEL POLYCRYSTALLINE MATERIAL IN SIMPLE EXTENSION. See Abstr. 7547

539.373

7562. PRECIPITATE INSTABILITY DURING UNIDIRECTIONAL EXTENSION OF AN AGE HARDENED ALUMINIUM–ZINC–MAGNESIUM ALLOY. I.J.Polmear and I.F.Bainbridge.
Phil. Mag. (Eighth Ser.), Vol. 3, 655-7 (June, 1958).

Reports that intense slip bands, but not modifications to the distribution of the precipitate, were observed in polished and etched sections from the interior of both tensile and fatigue specimens of the quaternary alloy (Al, 6% Zn, 3% Mg, 1% Cu). Details are given also of a study of metallographic changes associated with fatigue and tensile stressing of a series of high-purity Al–Zn–Mg alloys. S.Weintroub

539.373

7563. EVIDENCE FOR DISLOCATION BREAKAWAY IN PURE ALUMINUM. R.Truell and R.Bayer.
Phys. Rev., Vol. 110, No. 5, 1206-7 (June 1, 1958).

Acoustic attenuation and velocity measurements made on specimens of Al during deformation give evidence about the size and changes in size of dislocation loop lengths as well as dislocation density changes in the material. Pure Al in almost single crystal form, tested while subjected to tension, gave a very rapid increase in acoustic attenuation at low strains (below 0.02%), and this attenuation was much greater than that obtained with commercially pure material. The attenuation is considered to be proportional to the dislocation density multiplied by the fourth power of the loop length. The observed attenuation changes are considered not to result solely from changes in dislocation density and it is thought that the main part of the effect is due to sudden increase in the loop length at low strains. A.C.Whiffin

539.373

7564. ANELASTIC BEHAVIOUR OF SOLIDS AT HIGH TEMPERATURES. I.Barducci.
Ricerca sci., Vol. 28, No. 2, 313-22 (Feb., 1958). In Italian.

A brief review of the chief characteristics of the behaviour and the theoretical interpretations advanced by Bordoni and Nuovo and by Mason is followed by a discussion of the experimental results on the binary alloys Sn–Pb (see Abstr. 3029/1952), Bi–Sb (Barducci and Matta, Ricerca sci., Vol. 26, No. 4, 1160, 1956) and Wood's metal, which contribute to the determination of the dependence of the logarithmic decrement upon the frequency of oscillation and the temperature T. It is confirmed that the decrement is proportional to $\exp(-1/T)$ in accordance with both theories, but neither theory offers a satisfactory relation for the dependence on frequency. S.Weintroub

539.374 : 538.27 : 538.652

7565. PLASTIC DEFORMATION AND MAGNETOSTRICTION. G.Rieder.
Z. angew. Phys., Vol. 9, No. 4, 187-202 (April, 1957). In German.

Previous theories of internal strains as a result of plastic deformation are brought together in a single theory, which considers also the mechanical effects of crystal energy. This theory also takes into account plastic and quasi-plastic distortions. Classical elastic theory is extended by the introduction of antisymmetrical stress tensors. The application of this theory to problems of magnetization is considered; in particular, the effect of dislocations in impeding movement of domain walls and the relations between distractions and coercive force. A.E.De Barr

539.374

7566. THE DEFORMATION OF METALS BY SELF-DIFFUSION. A.P.Greenough.
Phil. Mag. (Eighth Ser.), Vol. 3, 1032-41 (Sept., 1958).

The experimental data on the deformation of metals at temperatures near their melting points is reassessed. It seems that at any given stress, an initial period in which the strain rate decreases is followed by a second period in which the strain rate is constant. The Nabarro—Herring theory satisfactorily accounts for the constant strain rate. In the initial period, the higher strain rate cannot entirely be attributed to offsetting and kinking at grain boundaries. It is suggested that edge dislocations may rotate about suitable nodes, and in planes normal to their slip planes, thus acting as sources or sinks for vacancies during the initial period. A.

539.382

7567. GRIP EFFECTS IN THE DEFORMATION OF SINGLE CRYSTALS. R.L.Fleischer and B.Chalmers.
J. Mech. Phys. Solids, Vol. 6, No. 4, 307-13 (July, 1958).

A calculation is made of the average shear stresses caused by the reaction with the grips during a tensile test of a single crystal. By adopting a suitable work-hardening description, effects of changing sample thickness can be understood for face-centred cubic metals. A.

539.4.016 : 537.311.31

RECOVERY OF ELECTRICAL RESISTIVITY OF Cu, Au, AND Ni FOLLOWING COLD WORK AT 4°K. See Abstr. 6952

539.42

7568. DETERMINATION OF THE TENSILE STRENGTH OF PORCELAIN. PROBLEMS AND METHODS. K.Bjorklund.
Chalmers Tekn. Hogsk. Handl., No. 193, 78 pp. (1958). In Swedish.

A comprehensive summary of methods for the determination of the tensile and bending strength of ceramic materials, in particular porcelain, with details of routine factory tests, tests for the comparison of different materials, shapes of test pieces and evaluation of existing standard methods, investigations into the most suitable shapes of test pieces and some fundamental investigations in connection with the strength of materials. As regards the tensile strength of ceramic materials, it is stated that the test results generally show a considerable scatter, even if the materials exhibit a very high degree of isotropy, and depend markedly on the volume of the test piece, the size and properties of the surface layers. The tensile strength is a function of the rate of increase of the load. The classical theory of the strength of materials is not entirely satisfactory, as applied to ceramic bodies. Numerous illustrations of test pieces and testing apparatus, and many tables of the mechanical properties of porcelain are given, also fringe photographs of test pieces, showing stresses under the grips. J.Smuts

539.501 : 532.13

7569. AN ATTEMPT TO GENERALIZE ONSAGER'S PRINCIPLE, AND ITS SIGNIFICANCE FOR RHEOLOGICAL PROBLEMS. H.Ziegler.
Z. angew. Phys., Vol. 9b, No. 5-6, 748-63 (1958).

Assumptions are made which lead to a symbolic connection between a set of Onsager reciprocal relations and some non-linear "force—velocity" relations with possible significance in rheological theory. J.G.Oldroyd

539.533

7570. THERMAL, PLASTIC AFTER-EFFECTS ON THE VICKER'S INDENTATION IN GLASS. W.Diehl and R.Schulze.
Z. angew. Phys., Vol. 9, No. 5, 251-3 (May, 1957). In German.

The indentation shows a tendency to recover, which is much increased at temperatures of 100°-300° C (the volume of the depression may be reduced to as little as 6%). Clear sillicate glasses and glasses with low charge-number cations show this effect, but glasses with high cation numbers do not. J.M.Hough

539.533

7571. ON THE MICRO-HARDNESS OF GLASS SURFACES. P.Joos.
Z. angew. Phys., Vol. 9, No. 11, 556-61 (Nov., 1957). In German.

An apparatus is described for scratching glass with a diamond point in vacuum or in an atmosphere of water vapour. In vacuum, and after heating the glass to free it from moisture, the scratching occurs by brittle fracture. In the presence of water vapour, the form of the scratch is different, and the scratching occurs by plastic deformation. A finite time, of the order of minutes, is required after the admission of water vapour for the transition from a brittle to a plastic scratch to take place. R.F.S.Hearmon

539.56

7572. BRITTLE RUPTURE OF ZINC SINGLE CRYSTALS. V.I.Likhtman, L.A.Kochanova and L.C.Bryukhanova.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 4, 757-60 (1958). In Russian.

Results are reported for the normal and shear stresses at rupture and for the limit of plastic shear of untreated and amalgamated zinc single crystals of various orientations at −196 and +20° C. The influence of temperature and amalgamation on the state of the crystal (brittle or plastic) is discussed. R.F.S.Hearmon

539.58

7573. DYNAMICAL COMPRESSIBILITY OF METALS UNDER PRESSURE FROM 400 000 TO 4 MILLION ATMOSPHERES. L.V.Al'tshuler, K.K.Krupnikov and M.I.Brazhnik.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 886-93 (1958). In Russian.

A method for determination of pressures and densities of shock compression is proposed which is based on the measurement of the velocities of propagation of strong shock waves. The dynamical compressibility of copper, zinc, silver, cadmium, tin, gold, lead and bismuth were measured by this method in the pressure range from 400 000 to 4 000 000 atm. The highest degree of compression (2.26 and 2.28 times) were observed in lead and bismuth, that is, in elements with the highest atomic volumes. The highest absolute density (32.7 g/cm^3) was recorded in gold. A.

539.58 : 534.222.2

SHOCK-WAVE COMPRESSIONS OF TWENTY-SEVEN METALS. EQUATIONS OF STATE OF METALS. See Abstr. 6744

539.621 : 539.232

7574. FRICTIONAL BEHAVIOUR AND STRUCTURE OF THE SURFACE OXIDES OF STEEL. Y.Tamai.
Brit. J. appl. Phys., Vol. 9, No. 8, 338-9 (Aug., 1958).

PHYSICAL CHEMISTRY

PHASE EQUILIBRIUM. CHEMICAL REACTIONS

541.124

7575. GEOMETRICAL AND STRUCTURAL UNIMOLECULAR ISOMERIZATION OF SYM-CYCLOPROPANE-d_2.
B.S.Rabinovitch, E.W.Schlag and K.B.Wiberg.
J. chem. Phys., Vol. 28, No. 3, 504-5 (March, 1958).

The homogeneous thermal isomerization of trans-cyclopropane-d_2 was investigated over a range of 60 deg, centred at 444°C. The geometrical and structural isomerization reactions occur simultaneously; and the first-order rate constants remained constant during a run. For geometrical isomerization three mechanisms are possible, of which intramolecular H migration and intermolecular exchange reaction were excluded by reacting the cis- and trans-isomers to equilibration. Thus ring rupture and reversible recyclization remain as the effective process for cis-trans-isomerization. From E_∞ = 64 kcal it is concluded that D(C – C) ≤ 64 kcal where D refers to ground states of cyclopropane and trimethylene.

J.Jacobs

541.124 : 535.333

7576. ORIGIN OF AFTERGLOWS IN MIXTURES OF NITROGEN AND OXYGEN. F.Kaufman.
J. chem. Phys., Vol. 28, No. 5, 992 (May, 1958).

The origin of afterglows and their spectra, in N_2–O_2 mixtures of varying composition, is quantitatively explained by luminous reactions between N and NO and O and NO (see Abstr. 6472/1958).

R.W.Nicholls

541.124

7577. KINETICS OF THE TRIIODIDE EQUILIBRIUM. O.E.Myers.
J. chem. Phys., Vol. 28, No. 6, 1027-9 (June, 1958).

The I^{127} nuclear magnetic resonance absorption line of iodide ion in aqueous solution is broadened by the presence of iodine molecules. The broadening is consistent with the diminution of phase-memory time caused by strong quadrupole coupling in triiodide ion, which occurs in dynamic equilibrium. On the basis of a simple bimolecular mechanism, the rate constants for the forward and reverse reactions of the triiodide equilibrium at 35°C are $(4.1 \pm 0.4) \times 10^{10}$ l./mole sec and $(7.6 \pm 0.8) \times 10^7$ sec^{-1} in the concentration ranges which were investigated. A.

541.124 : 539.18

CHEMICAL SHIFT EFFECT IN INNER ELECTRONIC LEVELS OF Cu DUE TO OXIDATION. See Abstr. 7424

541.126

7578. ON THE SLOW REACTION OF CARBON MONOXIDE WITH OXYGEN. R.H.Knipe and A.S.Gordon.
J. chem. Phys., Vol. 27, No. 6, 1418-19 (Dec., 1957).

See Abstract 8238 (1957). The rate of reaction of CO with oxygen at 600°C in a silica vessel was found to be affected by the method of introduction and the rate of introduction of the gases into the reaction vessel. The initial part of the pressure-time curve was not reproducible but consistent results were obtained for the later steady rate of reaction. The effect of ozone on the system is thought to be negligible. G.I.W.Llewelyn

541.126

7579. REPLY TO THE LETTER TO THE EDITOR ON "SLOW REACTION OF CARBON MONOXIDE WITH OXYGEN" BY R.H.KNIPE AND A.S.GORDON. P.Harteck and S.Dondes.
J. chem. Phys., Vol. 27, No. 6, 1419-20 (Dec., 1957).

A set of equations is proposed for the CO + O_2 reaction to interpret data obtained by the authors at 35°C and 100°C and by Knipe and Gordon (see preceding abstract) at 600°C. G.I.W.Llewelyn

541.126

7580. A DISCUSSION ON THE INITIATION AND GROWTH OF EXPLOSION IN SOLIDS.
Proc. Roy. Soc. A, Vol. 246, 146-297 (July 29, 1958).

This discussion was held at the Royal Society, London on May 30, 1957 under the leadership of F.P.Bowden. The following papers were presented: "Introduction", F.P.Bowden (146-54); "The initiation of explosion in solid secondary explosives", G.B.Cook (154-60); "The initiation of liquid explosives by shock and the importance of liquid break-up", C.H.Johansson and others (160-7); "Energy requirements for the ignition of seven solid explosives", G.J.Bryan and E.C.Noonan (167-75); "Initiation of condensed explosives by compression of the surrounding gas", J.I.Evans and A.M.Yuill (176-80); "Studies on the oxidation induced by ultrasonic radiation on a solid system of lauryl aldehyde and potassium chlorate", F.A.H.Rice and D.Levine (180-6); "The ignition of primary explosives by electric discharges", R.M.H.Wyatt, P.W.J.Moore, G.K.Adams and J.F.Sumner (189-96); "The explosion of silver azide in an electric field", F.P.Bowden (197-9); "Structure and stability of inorganic azides", B.L.Evans (199-202); "Thermal decomposition, inflammation and detonation", W.E.Garner (203-6); "The decomposition of silver azide", B.E.Bartlett, F.C.Tompkins and D.A.Young (206-12); "The initiation of explosion by neutrons, α-particles and fission products"*, F.P.Bowden (216-19); "The effect of nuclear radiation on explosives"*, J.V.R.Kaufman (219-25); "The effect of high energy X-rays and pile radiation on the thermal decomposition and thermal explosion of α-lead azide", J.M.Groocock (225-32); "Preparation and properties of crystals of KN_3 and NaN_3", R.W.Dreyfus and P.W.Levy (233-40); "The initiation of explosion by light", J.Eggert (240-7); "Ignition of explosives by light", J.H.L.McAuslan (248-50); "The optical and electrical properties of silver azide and their relation to its decomposition", A.C.McLaren and G.T.Rogers (250-3); "The growth of explosion in solids", A.D.Yoffe (254-7); "Some considerations on the mechanism of initiation of detonation in explosives", K.K.Andreev (257-67); "The initiation of explosives by shock", G.P.Cachia and E.G.Whitbread (268-73); "Sympathetic detonation and initiation by impact", R.J.Eichelberger and M.Sultanoff (274-81); "Deflagration to detonation transition in solid and liquid explosives", M.A.Cook, D.H.Pack and W.A.Gey (281-3); "The initiation of condensed explosives by shock waves from metals", W.R.Marlow and I.C.Skidmore (284-8); "The underwater shock-wave initiation of cast pentolite", C.H.Winning (288-96); "Conclusion", F.P.Bowden (296-7).

Abstracts of two papers (pp. 216-219; 219-225) whose titles are marked thus * are given below.

541.126

7581. THE INITIATION OF EXPLOSION BY NEUTRONS, α-PARTICLES AND FISSION PRODUCTS. F.P.Bowden.
Proc. Roy. Soc. A, Vol. 246, 216-19 (July 29, 1958).

"Initiation and growth of explosion" discussion paper (see preceding abstract). The author refers to earlier work (Abstr. 2282/1955) and concludes that the passage of a single particle (even a large fission fragment) will not cause the explosion of azides and other sensitive materials. It will, however, produce important changes in the crystal which affect the subsequent decomposition. D.A.Young, in discussion of Bowden's paper, added information on the effect of various pile and γ-irradiations on uranyl oxalate.

541.126

7582. THE EFFECT OF NUCLEAR RADIATION ON EXPLOSIVES. J.V.R.Kaufman.
Proc. Roy. Soc. A, Vol. 246, 219-25 (July 29, 1958).

"Initiation and growth of explosion" discussion paper (see preceding two abstracts). The results of a study to determine the relative resistance of a number of explosives to effects of low-energy γ-rays are presented. The data obtained from irradiating the materials at several temperatures by the 0.41 MeV γ-quantum emitted by Au^{198} demonstrate that no obvious correlation exists between the radiation resistance of explosives and their thermal stability, mechanical sensitivity or ignition temperature. In view of their well-known explosive behaviour, the resistance of explosives to irradiation decomposition is surprising. In some cases chemical instability during irradiation is detectable with difficulty even at doses of 10^6 r. It is evident from the data as well, that the chemical structures in question exhibit a varied resistance to radiation effects and suggest that resonance properties of certain molecules contribute markedly to radiation resistance. A.

541.126

7583. SPONTANEOUS IGNITION TEMPERATURE OF FUEL–NITRIC OXIDE MIXTURES. H.G.Wolfhard and A.Strasser.
J. chem. Phys., Vol. 28, No. 1, 172-3 (Jan., 1958).

Measurements for stoichiometric mixtures with NO, in a ceramic lined platinum furnace give the following values: NH_3,

800° C; C_2H_4, 1045°; CH_4, 1110°; H_2, 1320°; CO > 1500°. These support the view that, for CO and H_2, thermal decomposition of the NO is the first step, but the slight difference suggests that for H_2 either H atoms or OH may serve as intermediates. For NH_3 a chain reaction is likely. A.G.Gaydon

541.127

7584. THEORY OF DETONATIONS. I. IRREVERSIBLE UNIMOLECULAR REACTION. J.O.Hirschfelder and C.F.Curtiss.
J. chem. Phys., Vol. 28, No. 6, 1130-47 (June, 1958).

The composition, temperature, and pressure as functions of distance in a steady-state, plane gaseous detonation wave are studied. The effects of the coefficients of viscosity, diffusion and thermal conductivity are included. The basic equations are set up for a gas in which the irreversible unimolecular reaction A → B takes place with the release of energy. The topological nature of the solutions is discussed and some detailed numerical solutions are given. The numerical calculations (obtained by a point-by-point integration of the detonation equations) indicate a strong probability that there is a highest ambient pressure above which a steady-state detonation cannot take place, and indicate a possibility that there is an ambient pressure below which a detonation cannot occur. In the examples considered, there is strong coupling between the reaction zone and the shock zone so that the solutions never come close to the von Neumann "spike". If the Mach number is greater than unity, the solutions have an entirely different nature and exist for only a single ambient pressure rather than for a range of pressures. However, from hydrodynamical considerations, a detonation wave initiated from either a point or a fixed wall can become equivalent to the steady-state solutions only if the Mach number is greater than or equal to unity. A.

541.127

7585. THEORY OF DETONATIONS. II. REVERSIBLE UNIMOLECULAR REACTION.
B.Linder, C.F.Curtiss and J.O.Hirschfelder.
J. chem. Phys., Vol. 28, No. 6, 1147-51 (June, 1958).

The effect of a back reaction on the chemical and thermal profiles in a steady-state plane gaseous detonation wave supported by an exothermic unimolecular reaction is considered. Just as in the irreversible case, considered in the previous paper, the character of the solutions of the detonation equations change when the Mach number becomes greater than unity. However, in agreement with the conclusions of Wood and Kirkwood, for the reversible reaction, this critical Mach number has the value of unity only when it is defined in terms of the equilibrium velocity of sound. A.

PHOTOCHEMISTRY. RADIATION CHEMISTRY

541.15

7586. HYDROGEN YIELDS IN AQUEOUS SODIUM NITRATE SOLUTION BY COBALT-60 GAMMA RAY RADIATION.
H.A.Mahlman and J.W.Boyle.
J. chem. Phys., Vol. 27, No. 6, 1434 (Dec., 1957).

The hydrogen yields were found to fall as a function of the cube root of the nitrate ion molarity. See also Abstr. 1334-5. 5049 (1955). J.R.Mallard

DISPERSIONS. COLLOIDS. ADSORPTION

541.183

7587. ON THE PROTON MAGNETIC RESONANCE ABSORPTION OF SORBED WATER. A.Miyake.
J. chem. Phys., Vol. 27, No. 6, 1425-6 (Dec., 1957).

A theoretical determination of the peak intensity and line width of the proton magnetic resonance line of sorbed water is given, which is in agreement with the experimental results of Shaw and Elsken (Abstr. 8916/1950, 4796/1955). J.M.Baker

CHEMICAL STRUCTURE

541.6 : 537.534.3

7588. DIIMIDE — IDENTIFICATION AND STUDY BY MASS SPECTROMETRY. S.N.Foner and R.L.Hudson.
J. chem. Phys., Vol. 28, No. 4, 719-20 (April, 1958).

N_2H_2 was produced by electrical decomposition of hydrazoic acid and by electrical and thermal decomposition of hydrazine. The mass-spectrometer identification was confirmed by deuteronation. Properties of N_2H_2 found were: ionization potential 9.85 ± 0.1 eV, heat of formation 48.7 ± 5 kcal/mole, D(HN = NH) = 104 ± 6 kcal/mole. J.Hawgood

CHEMICAL ANALYSIS

545.827

7589. ISOTOPE DILUTION, α-SPECTROMETER FOR U AND Th DETERMINATION. L.E.Howard.
Nucleonics, Vol. 16, No. 2, 112, 114, 116, 118, 120-1 (Feb., 1958).

A method suitable for use with mineral samples containing U or Th or both. To estimate U in the absence of Th a known amount of ThO_2 (not containing Th^{230}) is intimately mixed with the sample. The thorium is extracted chemically and deposited as a thin film on the cathode of a gridded ion chamber. The recorded α-spectrum enables the proportion of the thorium isotopes to be determined. The U content of the sample is then calculated from the proportion of Th^{230}. To estimate Th in the absence of U a known quantity of uranium is added to the sample and a similar procedure followed. If both U and Th are present two extractions with and without added Th are made. Alternatively if Th of different isotopic composition from normal is added only a single isotopic analysis is necessary. R.D.Smith

CRYSTALLOGRAPHY

548.24

7590. TWINNING IN EXPLOSIVELY LOADED STEEL.
S.Singh and A.Soundraraj.
J. appl. Phys., Vol. 29, No. 1, 111-12 (Jan., 1958).

Describes the shock twinning of a 0.37% carbon steel subjected to explosive attack. Hollow cylinders, 16 cm in length, 2.5 cm internal diameter with a 9 cm wall thickness were used. Microstructure studies were made radially on a circular cross-section of the cylinder. Severe shock twinning was observed near the inner surface of the cylinder with a maximum number of four twinning directions in any single ferrite grain. Results indicate that the critical stress for twinning increases with carbon content. R.Bullough

548.24 : 539.27

7591. TWINNING IN TABULAR PHOTOGRAPHIC GRAINS.
J.F.Hamilton and L.E.Brady.
J. appl. Phys., Vol. 29, No. 6, 994 (June, 1958).

Photographic silver bromide grains were prepared for the electron microscope to expose the six side-faces of the octohedral crystal. These faces show evidence of twinning, confirming the results of X-ray diffraction studies by previous authors. A.E.I. Research Laboratory

548.51

7592. MECHANISMS OF NUCLEUS FORMATION IN CRYSTALS.
U.Dehlinger.
Z. Phys., Vol. 149, No. 5, 647-54 (1957). In German.

A non-mathematical discussion, concerned mainly with explaining the observed orders of magnitude of the energy of nucleus formation in phase changes. A.R.Stokes

548.52

7593. ON CHANGES IN THE SHORT-RANGE STRUCTURE IN THE PRE-CRYSTALLIZATION PERIOD IN SEMICONDUCTING CHEMICAL COMPOUNDS WITH ZnS TYPE LATTICES.
D.A.Petrov and V.M.Glazov.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 2, 293-5 (1958). In Russian.

On lowering the temperature in the pre-crystallization period in chemical compounds of the zinc-blende type a significant change in the short-range order takes place. This is in the direction of

decreasing the coordination number and the approach of the liquid structure to the structure appropriate to the compound in the solid state. The assumption that the changes indicated are absent on supercooling is supported by the absence of a sufficiently sharp rise in the experimental curve of the temperature dependence of viscosity at temperatures near to the temperature of crystallization.

A.L.Mackay

548.52 : 548.7

7594. GROWTH AND DEFECT OF STRUCTURE OF SAPPHIRE MICROCRYSTALS. W.W.Webb and W.D.Forgeng.
J. appl. Phys., Vol. 28, No. 12, 1449-54 (Dec., 1957).

Examination of small euhedral crystals of α-Al_2O_3 (sapphire) that were observed following oxidation of aluminium and an aluminium alloy in wet hydrogen at high temperatures showed that growth probably occurs by decomposition of AlO on an Al_2O_3 surface. Rapid growth occurs on the tips of needles and the edges of platelets at lattice steps formed by intersection of hollow screw dislocations with these surfaces. Screw dislocations were detected by X-ray measurement of the lattice twist they produce in the needle-like crystals or "whiskers". Needles were bent to elastic strains of over 2% corresponding to a strength of 10^{11} dyn/cm^2. A.

548.522

7595. WHISKER GROWTH FROM IODIDE TITANIUM WIRE.
A.M.Russell and R.C.Abbott.
J. appl. Phys., Vol. 29, No. 7, 1130-1 (July, 1958).

Ti wire heated in vacuum, was subjected to temperature cycling between 800 and 1100°C at a rate of 6 cycles per minute. Whiskers appeared after about 200 cycles, and were fully grown within a few cycles. J.Franks

548.522

7596. ON THE GROWTH OF METAL WHISKERS BY HYDROGEN REDUCTION OF HALIDES. W.W.Webb and E.F.Riebling.
J. chem. Phys., Vol. 28, No. 6, 1242-5 (June, 1958).

Observations were made of the pressures of hydrogen and hydrogen halide gases prevailing during growth of a variety of metal whiskers by hydrogen reduction of volatile metal halides. The orders of magnitude of the maximum metal activities observed are only 1 to 100 rather than the maximum thermodynamically feasible values of 10^4 to 10^6 that might be attained in these reactions. This result is more in accord with current theories of whisker growth. It appears that the reduction of metal halide occurs primarily on the whisker surface and that metal halide vapour rather than metal vapour provides most of the vapour-phase mass transport during whisker growth by this process. A.

548.53

7597. THE TREATMENT OF ROCHELLE SALT SURFACE.
F.Asselmeyer and W.Bienert.
Z. angew. Phys., Vol. 9, No. 5, 253-5 (May, 1957). In German.

Describes a method of improving the surface by re-crystallization by contact with water vapour. The treated surface is much more stable in vacuum and dry air than the normal surface.

J.M.Hough

548.55 : 537.226.2

7598. GROWING OF FERROELECTRIC $PbTiO_3$ CRYSTALS.
J.Kobayashi.
J. appl. Phys., Vol. 29, No. 5, 866-7 (May, 1958).

A detailed description is given of a method for growing thin single crystals, suitable for the investigation of dielectric and ferroelectric domain properties. Preliminary results suggest that the coercive field at room temperature is too high to permit the excitation of hysteresis loops at 60 c/s, though slow domain reversal has been observed in strong static fields. L.E.Cross

548.55

7599. PREPARATION OF SINGLE CRYSTALS OF HEXAGONAL SELENIUM. P.T.Kozyrev.
Zh. tekh. Fiz., Vol. 28, No. 3, 500-5 (1958). In Russian.

Two methods of growing the crystals are described: by condensation from Se vapour, and by directional cooling of the fused material. Single crystals measuring 15 x 5 x 5 mm were obtained by either process, the main difficulty inherent in both methods being a very slow rate of crystal growth (0.1 mm/hr). Comparison with the results of an earlier investigation (Nasledov and Kozyrev, Zh. Tekh. Fiz., Vol. 24/2124-35, No. 12, 1954) shows that the rate of crystallization of Se under pressure of 4000 atm is approximately 10^3 times higher than under normal conditions. It is postulated that the main cause of the slow crystallization rate of Se is the closed chain structure of amorphous Se molecules. Such molecules can take part in the formation of a crystal only after the chain has been broken by thermal vibrations. Since this process depends on the activation energy, the number of broken-up molecules is small in comparison with the total number of molecules in the melt. Under hydrostatic pressure the activation energy is lower and consequently the rate of the formation of the crystalline phase is increased. The possibility of purifying Se by zone refining under pressure is discussed. M.H.Sloboda

548.572

7600. FORMATION OF GROWTH SPIRALS ON CUPROUS OXIDE GROWN ON COPPER SINGLE CRYSTALS. G.T.Miller and K.R. G.T.Miller and K.R.Lawless.
J. appl. Phys., Vol. 29, No. 5, 863-4 (May, 1958).

Single crystal spheres of 99.999% Cu with ground and electropolished faces parallel to (100), (111), (110), (311) or (210) planes were oxidized by immersion in $CuSO_4$ solution with O_2 concentration of 10^{-4} mg/l. Polyhedral single crystals of cuprous oxide were formed, having complex step and spiral structures on their surfaces. Polyhedra show generally only (111), (100) and (110) faces with spirals mostly on (111). Height of spiral steps was 100-200 A. Among possible explanations of origin, authors suggest that spirals may originate at junction between two growing crystals with slight relative misorientation, indicating that later stages of growth at least are controlled by dislocations. J.W.Menter

548.574

7601. NEW OBSERVATIONS OF DISLOCATIONS IN GERMANIUM. H.Dorendorf.
Z. angew. Phys., Vol. 9, No. 10, 513-19 (Oct., 1957). In German.

Reports, with many photographs of etch-pit patterns, observations of: (a) the general straightness of dislocation lines, apart from occasional jogs, over lengths up to a few mm; (b) the dense triangular and star-like patterns of etch-pits, due to plastic deformation of the crystal during growth from the melt and subsequent more or less rapid cooling, seen on surfaces cut normal to the (111) growth axis; (c) the movement of, and reactions between, dislocations as a result of annealing at 750°-800°C. F.F.Roberts

548.574

7602. ETCHING AND POLISHING OF GERMANIUM SURFACES.
D.Geist and E.Preuss.
Z. angew. Phys., Vol. 9, No. 10, 526-31 (Oct., 1957). In German.

Summarizes the results of an investigation of the surface finishes produced by etchants of the H_2O–HF–HNO_3 and H_2O–HF–H_2O_2 types containing small additions of $AgNO_3$, as functions of composition at a few temperatures. A KCN rinse removes deposited Ag and, for suitable etchant composition, leaves an optically flat surface substantially free of Ge oxide. Other etchants are suitable for use in determining crystal orientation from the etch pit form. Mechanical polishing on etchant-soaked leather is also reported, as well as the use of concentrated H_2SO_4 at 50°C for revealing crystal defects. F.F.Roberts

X-RAY CRYSTALLOGRAPHY

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also under "Structure of solids". Decimal classification 539.26/.27

548.733

7603. THE MEASUREMENT OF X-RAY INTERFERENCE FRINGES WITH CADMIUM SULPHIDE CELLS.
H.Simon and M.v.Heimendahl.
Ann. Phys. (Leipzig), Vol. 20; No. 7-8, 355-67 (1957). In German.

An X-ray camera is described with a high stability CdS crystal as detector. With a potential of 10.5 V across the crystal, the dark current was 2×10^{-9} A; the response was linear to 2×10^{-6} A. The apparatus was used as a crystal spectrograph and for Debye–Scherrer measurements. J.Franks

548.733

7604. A NEW EXPERIMENTAL TECHNIQUE FOR X-RAY DIFFRACTION STUDY. K.Das Gupta and N.Pan.
J. sci. industr. Res., Vol. 17B, No. 3, 131-3 (March, 1958).

A brief description of a circular-focusing powder-camera with a fine-focus X-ray source incorporated; the target lying on the circumference of the camera and the whole being evacuated to 10^{-6} mm Hg. Very short exposure times, and a wide range of characteristic wavelengths, are claimed. A.R.Stokes

548.734

7605. ANALYTICAL DETERMINATION OF TRANSMISSION FACTORS OF SINGLE CRYSTALS. I. SINGLE CRYSTALS OF UNIFORM SQUARE OR RECTANGULAR CROSS-SECTION AND HIGH ABSORBING POWER. G.Carazzolo and M.Mammi.
Ricerca sci., Vol. 26, No. 11, 3342-51 (Nov., 1956). In Italian.

The method is derived from Howell's graphical method (Abstr. 8329/1950). Results of some calculations are expressed graphically.
A.R.Stokes

548.734.8

7606. TEMPERATURE CHARACTERISTIC OF X-RAY INTENSITY REFLECTION FROM CRYSTALS HAVING ZINCBLENDE- AND WURTZITE-TYPE STRUCTURES. S.Miyake and S.Hoshino.
Rev. mod. Phys., Vol. 30, No. 1, 172-4 (Jan., 1958).

Discusses three possible interpretations of the observed rise of intensity with temperature of the 200, 222 and 420 reflections of CuI.
A.R.Stokes

548.735 : 539.2

7607. DIRECT OBSERVATION OF INDIVIDUAL DISLOCATIONS BY X-RAY DIFFRACTION. A.R.Lang.
J. appl. Phys., Vol. 29, No. 3, 597-8 (March, 1958).

Dislocation lines in a 3 mm slice of Si made visible by either local increase in reflecting power of crystal or by alteration of energy distribution between multiply reflected primary and diffracted beams. Bragg reflection using planar sheet of X-ray illumination reveals lines of enhanced intensity, which have been identified as dislocation lines by examining same specimen in infrared illumination after decoration with copper.
J.W.Menter

548.735 : 538.221

7608. THE CRYSTAL STRUCTURES OF A NEW GROUP OF FERROMAGNETIC COMPOUNDS. P.B.Braun.
Philips Res. Rep., Vol. 12, No. 6, 491-548 (Dec., 1957).

The crystal structures of four new compounds are described. The chemical formulae of two of these compounds were found simultaneously with the structure. The new compounds are:

$Ba\ Fe^{II}_2Fe^{III}_{16}O_{27}$	$P6_3/mmc$	c = 32.845 A	a = 5.88 A
$Ba_2Fe^{II}_2Fe^{III}_{28}O_{46}$	$R\bar{3}m$	c = 84.11 A	a = 5.88 A
$Ba_2Zn^{II}_2Fe^{III}_{12}O_{22}$	$R\bar{3}m$	c = 43.558 A	a = 5.876 A
$Ba_3Co^{II}_2Fe^{III}_{24}O_{41}$	$P6_3/mmc$	c = 52.30 A	a = 5.885 A

The structures of these compounds and the magnetoplumbite structure are mutually related. Oxygen and barium atoms together form a slightly expanded close-packed arrangement, with the barium atoms in certain selected positions, and the smaller irons in certain of the holes between the large ones. In all of these structures, "plates", either four or six oxygen layers thick, can be distinguished, which have very nearly the spinel structure. The relations between the structures are discussed. A machine is described for the automatic summation of Fourier series with 60 cosine- and 60 sine-terms.
A.

548.735 : 539.2

7609. SOME EMPIRICAL PROBLEMS CONCERNING ATOMIC BONDS. H.D.Megaw.
Rev. mod. Phys., Vol. 30, No. 1, 96-9 (Jan., 1958).

The problems considered are: the validity or otherwise of regarding an $(OH)^-$ group as having the electron density of an O^- ion superimposed on an H atom; the effect of temperature on bond length and bond coordination number.
A.R.Stokes

548.735.4

7610. APPARATUS FOR MECHANICAL DETERMINATION OF INTERPLANAR DISTANCES IN THE LATTICE. F.Kgol'.
Kristallografiya, Vol. 2, No. 5, 604-8 (1957). In Russian.

The apparatus consists of straight edge and protractors and is designed to solve the basic X-ray analysis equations $\cos\eta = \lambda/2d$ and $2\eta = r/D$, where d is the interplanar distance, λ is the wavelength of the X-rays, D is the distance between the sample and the X-ray film and r is the radius of the interference circle.
R.F.S.Hearmon

548.736.5 : 538.245

CRYSTAL STRUCTURE OF $BaO.6Fe_2O_3$ WITH Fe SUBSTITUTED BY Al, Ga, Cr. See Abstr. 7194

548.736.1 : 539.2

7611. ANOMALOUS TRANSMISSION OF X-RAYS BY SINGLE CRYSTAL GERMANIUM. L.P.Hunter.
Proc. K. Ned. Akad. Wetensch. B, Vol. 61, No. 3, 214-19 (1958).

The anomalous transmission of X-rays through nearly perfect crystals was used to investigate the presence of dislocations, and of the strain field around dislocations in nearly perfect germanium crystals. Monochromatic Cu K α radiation was employed; the intensity was measured by means of a proportional counter. A few hundred dislocations per square cm can be measured.
A.E.I. Research Laboratory

548.736.3

7612. X-RAY INVESTIGATION OF THE SHORT-RANGE ORDER OF Cd AMALGAMS IN THE LIQUID STATE. D.M.Karlykov.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 43-8 (1957). In Ukrainian.

Cd–Hg amalgams were studied having concentrations of 13.9, 16.5, 18, 30.8% Cd. Over this range the coordination number, as found from atomic distribution curves, varies from 8.3 to 8.8 units. Diffraction pattern analysis shows that liquid Cd amalgams belong to the physical solvents group.
C.R.S.Manders

548.74

7613. EFFECT OF INELASTIC WAVES ON ELECTRON DIFFRACTION. H.Yoshioka.
J. Phys. Soc. Japan, Vol. 12, No. 6, 618-28 (June, 1957).

The effect of inelastic scattering on electron diffraction by crystals is theoretically studied. It is proved that the effect of inelastic scattering gives rise to an additional complex term to the Fourier coefficient of the inner potential. The imaginary part of the additional term explains qualitatively the observation that two components of a doubly refracted electron beam are subjected to different degrees of absorption (Honjo and Mihama, Abstr. 7041/1954). The real part of the additional term gives a correction of about 6-7% to the calculated value of mean inner potential at accelerating voltages of 30-40 kV. This explains the systematic difference between the mean inner potential experimentally obtained by electron diffraction and that calculated by the use of diamagnetic susceptibility.
A.

548.74

7614. EXTRA REFLECTION BY DYNAMICAL SCATTERING. A. Goswami.
J. sci. industr. Res., Vol. 17B, No. 3, 133-5 (March, 1958).

Secondary reflection is used to explain appearance of "forbidden" reflections in electron diffraction by oriented silver deposits on a copper (111) face.
A.R.Stokes

548.74

7615. FOURIER METHODS IN STRUCTURE ANALYSIS BY ELECTRON DIFFRACTION. J.M.Cowley and A.L.G.Rees.
Rep. Progr. Phys., Vol. 21, 165-225 (1958).

A comprehensive account is given of the present stage of development of electron diffraction as applied to the elucidation of crystal structures. In the introduction, much of the earlier work is reviewed and the theoretical ideas involved in using Fourier synthesis methods with electron diffraction intensities are explained. Other sections deal with the measurement of intensities and their use in structure analysis with both polycrystalline and single crystal specimens. The use of dynamic scattering effects in determining structures is discussed in relation to specific examples. The final section reviews the recent work on direct observation of crystal lattices with the electron microscope and indicates the possible direction of future development. The list of references covers most of the publications, on this subject, in Europe, U.S.A. and Russia.
J.Iball

GEOPHYSICS

550.34 : 534.2

GRAPHO-ANALYTICAL METHOD OF FREQUENCY ANALYSIS OF SEISMIC WAVES OVER A WIDE RANGE OF FREQUENCIES. See Abstr. 6734

550.38 : 518.5

7616. NUMERICAL INTEGRATION OF GEOMAGNETIC FIELD LINES. L.Block and N.Herlofson.
Tellus, Vol. 8, No. 2, 210-14 (May, 1956).

A total of 123 geomagnetic field lines were integrated by an electronic computer, taking into account also the quadrupole terms of the potential. A table gives the coordinates of the two points of intersection, one in the northern and one in the southern hemisphere, between the earth's surface and each calculated field line. A.

550.385

7617. THE AVERAGE ELECTRIC CURRENT SYSTEM FOR THE SUDDEN COMMENCEMENTS OF MAGNETIC STORMS.
J.A.Jacobs and T.Obayashi.
Geofis. pura appl., Vol. 34, 21-35 (1956/II).

A statistical investigation of the world-wide electric current-systems corresponding to this type of storm was carried out. The storm-time variation Dst and the disturbance diurnal variation Ds are derived separately from the results of the average local-time variations in the magnetic field at different latitudes. A conspicuous Ds current-system is found in the inner polar regions, and a concentrated current-flow is also confirmed along the geomagnetic equator resembling the current-system of an enhanced Sq-field. The inner polar region currents flow towards the meridian at about 9 hr local-time and are supposed to complete their path along the outer auroral zone in opposite directions in the forenoon and afternoon hemispheres. It is of interest that the pattern of this atmospheric electric current-system is very similar to that caused by an electric doublet centred on the highly conducting region near the pole. Some observed facts concerning the statistical nature of sudden-commencements can be explained by these current-systems. A.

550.385 : 551.594.5

7618. ON THE THEORY OF MAGNETIC STORMS AND AURORAE. E.Åström.
Tellus, Vol. 8, No. 2, 239-40 (May, 1956).

Mathematical treatment of the basic problem of the motion of ionized gas in the electric, and magnetic fields of the sun and earth yields a formal proof of Alfven's suggestion (Abstr. 7548/1955) that in the zone of equality of solar and terrestrial magnetic field-intensities, the current caused by drift motion of the ions in the crossed magnetic and electric fields and that due to inertia of the charged particles combine to produce a circular current flow around the earth. D.R.Barber

550.385 : 523.75

SOLAR ACTIVITY AND GEOMAGNETIC DISTURBANCES IN 1942-1944. See Abstr. 6596

551.46.018.9 : 535.345.1

7619. A TRANSPARENCY-METER FOR OCEAN WATER.
N.G.Jerlov.
Tellus, Vol. 9, No. 2, 229-33 (May, 1957).

The significance of the geometry of the optical system in extinction measurements for a liquid dispersion is emphasized. In particular, the mechanism by which light is lost by scattering in a transparency-meter in the sea is discussed. The strongly selective absorption of yellow substance is demonstrated. A new transparency-meter sufficiently accurate for measurements in clear ocean water is described. A long optical-path in the meter is attained by multiple reflection between three concave mirrors of equal curvature. The depth is recorded by means of a new device. A.

ATMOSPHERE. METEOROLOGY

551.510.3

7620. HIGH-ALTITUDE ATMOSPHERIC DENSITY. T.E.Sterne.
Phys. of Fluids, Vol. 1, No. 3, 165-70 (May-June, 1958).

Atmospheric density values obtained from the motion of artificial earth satellites, at altitudes between 186 and 656 kilometers, are discussed. There is some doubt about the reliability of densities from satellites because of the effects of ionization and, in the case of nonspherical satellites, because of their orientation. Densities inferred from satellites are higher than for the A.R.D.C. model of the atmosphere. These densities are about ten times higher than densities inferred from rocket-borne ionization gauges between 186 and 230 kilometers. The inference of atmospheric density from rocket-borne ionization gauges is discussed critically, and densities so obtained are considered to be inferior in reliability to the satellite densities. The satellite densities suggest molecular scale temperatures higher than those of the A.R.D.C. model in one or more regions of altitude above 80 kilometers. A.

551.510.3 : 525.3

7621. FORMULA FOR INFERRING ATMOSPHERIC DENSITY FROM THE MOTION OF ARTIFICIAL EARTH SATELLITES.
T.E.Sterne.
Science, Vol. 127, 1245 (May 23, 1958).

Assuming that the atmospheric density near perigee can be represented by the formula $\rho_\pi \exp(-Kz)$ with altitude z above perigee, the following approximate formula for density ρ_π at perigee can be used:

$$\rho_\pi = -4.826 \times 10^{-13} \times \dot{P} \left(\frac{m}{AC_D} \right) \frac{c^{1/2}}{af(c,e)} \quad g/cm^3,$$

where P is the rate of change of period in seconds per day; m the satellite mass in grams; A the cross-sectional area normal to the direction of motion, in cm^2; C_D the drag coefficient (~ 2) a the orbital mean distance in units of the earth's radius (6378 km); $c = 6378Kae$ for z in kilometres; e the orbital eccentricity; and

$$f(c,e) = 1 + 2e + \frac{3e^2}{2} + \frac{1 - 6e - 10.5e^2}{8c} + \frac{9 + 30e + 85.5e^2}{128c^2} + \ldots$$

The derivation of the formula is not given.

M.W.Ovenden

551.510.42 : 677.01

7622. ATMOSPHERIC POLLUTION AND THE SOILING OF TEXTILE MATERIALS. W.H.Rees.
Brit. J. appl. Phys., Vol. 9, No. 8, 301-5 (Aug., 1958).

The paper opens with a discussion of the factors which influence the soiling of textile materials by airborne dirt and of a method for measuring and expressing the extent of soiling of textile materials. An account is then given, with experimental data, of the soiling of textile fabrices by exposure to moving air, by thermal precipitation and by electrostatic attraction of airborne particles, and of the effect of fabric wettability on the appearance of a cotton fabric soiled by exposure to a damp polluted atmosphere. Finally, the paper introduces the "murk" unit of air dirtiness and deals briefly with the measurement of atmospheric murk values. Typical data for a residential district are given showing differences in the magnitude and diurnal variation of air dirtiness in summer and autumn. A.

551.510.535

7623. A GENERAL FORMULA FOR THE MORNING F2-IONIZATION AT EUROPEAN STATIONS. O.Burkard.
Geofis. pura appl., Vol. 34, 207-10 (1956/II). In German.

The squares of critical frequencies $(f_0F_2)^2$ measured at European stations on a summers morning may be represented by

$$(f_0F_2)^2 = K \left(\frac{\cos\chi}{\cos^2\varphi} \right)^x \cos^2\varphi,$$

where χ is the zenith angle of the sun, and φ the geographical latitude of the ionospheric station. The index x depends on the locality, but K is independent of it and probably characteristic of the intensity of the sun's ionizing radiation. A.

551.510.535 : 537.534.3

7624. MASS DETERMINATION OF [IONOSPHERIC] IONS DETECTED BY BENNETT ION R.F. MASS SPECTROMETER.
C.Y.Johnson.
J. appl. Phys., Vol. 29, No. 4, 740-1 (April, 1958).

Describes a method of calibration based on "harmonics" which enables absolute ion mass to be determined in the ionosphere. The use of this method solves some of the problems of mass identification of some previous data as some prominent peaks are in fact "harmonics". J.M.Hough

551.510.535

7625. NEW ROCKET MEASUREMENT OF IONOSPHERIC CURRENTS NEAR THE GEOMAGNETIC EQUATOR. L.J.Cahill, Jr and J.A.Van Allen.
J. geophys. Res., Vol. 63, No. 1, 270-3 (March, 1958).

Using a nuclear free-precession total field magnetometer, a sudden change was observed in the shape of the total intensity v. height curve at about 97 km. This was best explained in terms of the entry of the rocket into a region where a current sheet exists.

J.M.Hough

551.510.535

7626. ION COMPOSITION OF THE ARCTIC IONOSPHERE. C.Y.Johnson, E.B.Meadows and J.C.Holmes.
J. geophys. Res., Vol. 63, No. 2, 443-4 (June, 1958).

Using a mass spectrometer in an Aerobee-Hi rocket, measurements were made at Fort Churchill, Manitoba, of the concentration of positive ions (32, 30 and 16 a.m.u.) as a function of height, up to about 250 km. Ions of 16 a.m.u. do not appear below 130 km but predominate above 200 km. Other ions of both signs were also reported.

J.M.Hough

551.510.535

7627. EQUATORIAL SPREAD-F AND MAGNETIC ACTIVITY. A.J.Lyon, N.J.Skinner and R.W.Wright.
Nature (London), Vol. 181, 1724-5 (June 21, 1958).

The incidence of spread-F echoes at equatorial stations was found to be markedly reduced on magnetically disturbed days, in contrast to the opposite effect at temperature latitude stations. In the southern hemisphere, the transition between the two types of station occurs at about 20°S.

G.M.Brown

551.510.535 : 621.396.8

7628. INVESTIGATION OF THE NON-HOMOGENEOUS STRUCTURE OF THE F-LAYER OF THE IONOSPHERE. E.G.Proshkin and B.L.Kashcheev.
Radiotekhnika i Elektronika, Vol. 2, No. 7, 819-25 (1957). In Russian.

Observations of the non-homogeneities of the F-layer by means of the vertical radiowave measurements were made in Kharkov between July 1954 and May 1956. The results are tabulated and they show that: (a) values of β (coefficient of non-homogeneity of the reflecting region) obey Rayleigh's law; (b) in 90% of cases the reflections from the F-layer are random in character; (c) in conformity with the law there exist diurnal and seasonal changes of the structure of the F-layer.

Z.F.Voyner

551.510.535

7629. ON THE QUESTION OF THE FLUCTUATIONS OF ELECTRON CONCENTRATION IN THE F-LAYER OF THE IONOSPHERE. E.G.Proshkin and B.L.Kashcheev.
Zh. éksper teor. Fiz., Vol. 33, No. 4(10), 1062 (1957). In Russian. English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 818-19 (April, 1958).

Assuming inhomogeneities of a size 300 m in the F-layer, vertical incidence data were used to calculate the distribution of fluctuations of electron density, according to the formula of Al'pert. The most frequent values lie between 0.003 and 0.005 cm^{-3} for the ordinary wave.

G.M.Brown

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also under "Electromagnetic waves and oscillations". Decimal classification 538.566.3

551.510.536

7630. LARGE-AMPLITUDE HYDROMAGNETIC WAVES ABOVE THE IONOSPHERE. A.J.Dessler.
Phys. Rev. Letters, Vol. 1, No. 2, 68-9 (July 15, 1958).

Hydromagnetic waves are assumed to be generated by variations in the density or velocity of the ionized coronal gas at the edge of the earth's dipole field (at 6-10 earth radii). These waves will be propagated downward and the variation of velocity with altitude is discussed. They may be observed at the surface of the earth as fluctuations in the geomagnetic field.

G.M.Brown

551.515

7631. ON THE PROPAGATION OF WAVES IN A LOCALLY ISOTROPIC TURBULENT MEDIUM WITH SMOOTHLY VARYING CHARACTERISTICS. V.I.Tatarskiĭ.
Dokl. Akad. Nauk. SSSR, Vol. 120, No. 2, 289-92 (1958). In Russian.

A mathematical continuation of previous work (Abstr. 7089/1956).

J.M.Hough

551.521.326

7632. THE NIGHT AIRGLOW FROM THE 6300 A RED LINE OF OXYGEN. D.Barbier.
C.R. Acad. Sci. (Paris), Vol. 246, No. 19, 2780-1 (May 12, 1958). In French.

The results of ~ 2500 photometric observations made at Haute-Provence, and at Tamanrasset, between March 1956 and March 1958 are analysed, and the pertinent features collated and discussed.

D.R.Barber

551.521.326

7633. RELATIVE INTENSITIES OF THE OXYGEN LINES AT 5577 A AND 6300 A IN THE NIGHT SKY. B.P.Sandford.
Nature (London), Vol. 181, 42-3 (July 12, 1958).

Spectrographic observations of the night-sky light made at Invercargill, New Zealand, during the period from August to December 1957, indicate that there is a distinct tendency for the 5577 A line to be more intense than that at 6300 A whenever geomagnetic activity is low (K = 0, or 1): conversely, with high values of K(≥ 4) there is a high probability that the 6300 A line will be the dominant emission in the spectrum.

D.R.Barber

551.524.1

7634. THERMAL STRUCTURES IN THE LOWEST LAYERS OF THE ATMOSPHERE. R.J.Taylor.
Austral. J. Phys., Vol. 11, No. 2, 168-76 (June, 1958).

An analysis was made of a number of records of simultaneous fluctuations of temperature at four heights. The results show that the correlation between temperatures at two heights is greatest when the records are displaced relatively to each other, so that earlier points in the upper record are considered together with later points in the lower, by an amount depending on the mean wind speed difference between the two heights. The correlation increases with height relatively to what would be expected in a locally isotropic turbulence. This and other evidence points to the existence of organized thermal structures of considerable vertical extent which are superimposed on a background of random turbulent disturbances. It is probable that these structures represent convection plumes.

A.

551.574.1

7635. THE PHYSICS OF PRECIPITATION IN CUMULUS CLOUDS. R.R.Braham,Jr.
Geofis. pura appl., Vol. 35, 126-38 (1956/III).

The analysis of measurements, made over the past years at the University of Chicago, has made it possible to isolate the sublimation-coalescence mechanism (Bergeron process) from the condensation—coalescence mechanism and to estimate the relative role of each process in the formation of rain in cumulus clouds. It is found that size of cloud capable of raining is a strong function of geography, that the environment of the cloud is very important in determining the probability of rain and that liquid water content is one of the most important within-cloud parameters. An essential part of the research concerned cloud treatment. Definite, positive treatment effects were demonstrated for rain initiation through coalescence using water spray. No effects were detectable from dry ice seeding of subcooled clouds, although any such effects may have been obscured by sample size (27 cloud pairs).

A.

551.579.5 : 539.12

7636. CALIBRATION AND FIELD USE OF THE NEUTRON SCATTERING METHOD OF MEASURING SOIL WATER CONTENT. J.W.Holmes.
Austral. J. appl. Sci., Vol. 7, No. 1, 45-58 (March, 1956).

The method of measuring water content of soil by neutron scattering was studied with the intention of developing a convenient technique for calibration and field use. Neutron transport theory provides a basis for calculating a calibration curve expressed as counting rate v. water content. The agreement between the computed curve and measured water contents is encouraging though further use of neutron theory involving some refinement and fewer simplifying assumptions would be desirable. An example is given of the use of the method for the measurement in situ of soil water content. The evaporation from the land surface was derived from a sequence of measurements and the technique promises to be most useful for research of this kind.

A.

551.590.21

7637. INTERACTION OF THE SOLAR WIND WITH THE GEOMAGNETIC FIELD. E.N.Parker.
Phys. of Fluids, Vol. 1, No. 3, 171-87 (May-June, 1958).

The dynamical properties of the solar wind blowing past the

geomagnetic field are investigated by considering the effective viscosity and the resulting transition layer thickness. The collision of ions in the solar wind produces a negligible viscosity in the flow past the geomagnetic field, but such an inviscid flow is shown to be unstable. The resulting disordered interface between the field and the wind yields Fermi acceleration of ions and consequently a not insignificant effective viscosity. The Fermi acceleration results in suprathermal ions which may have an energy spectrum like that observed for primary auroral protons. The auroral zones and the agitated nature of the polar geomagnetic field are shown to follow from the depth of penetration of the solar wind into the geomagnetic field. The injection of gas into the geomagnetic field is studied. The effect at the earth of the distortion of the outer boundary of the geomagnetic field is computed; no matter how unevenly and anisotropically the outer field is distorted, the effect at the earth is a nearly uniform perturbation field which is closely parallel to the geomagnetic axis. Pushing in on the outer field increases the horizontal component at the earth, and pulling out decreases it; the total increase of the horizontal component is the algebraic sum of all the pushing and pulling. The simultaneous world-wide onset and the main phase of a geomagnetic storm follow. The common tendency of large and/or violent bodies of plasma to produce suprathermal particles is noted and suggested to be a general dynamical property.

A.

551.594.13

7638. ON THE ATMOSPHERIC DYNAMO THEORY. M.L.White.
J. geophys. Res., Vol. 62, No. 2, 329-30 (June, 1957).

Note in which the basic equations of tidal oscillations are given for an ionized gas in the presence of the earth's magnetic field. It appears that several assumptions made by previous workers can be avoided, and the equations can be greatly simplified if it is assumed that the neutral particle density markedly exceeds the density of ions and electrons. G.M.Brown

551.594.221

7639. VISIBLE ELECTRICAL DISCHARGES INSIDE THUNDERCLOUDS. D.J.Malan.
Geofis. pura appl., Vol. 34, 221-36 (1956/II).

Lightning discharge streamers are occasionally visible inside and above the base of isolated convection thunderclouds. Two photographs of such a transparent cloud are discussed. They show that the negatively charged region reaches to an altitude of 8 km and has a horizontal width of about 8 km. A.

551.594.221

7640. ON THE PROPERTIES OF LONG-GAP STREAMERS. K.Honda.
J. Phys. Soc. Japan, Vol. 12, No. 12, 1403-12 (Dec., 1957).

A systematic explanation of long-gap streamers (including step-leaders) in lightning discharges is presented. Various parameters affecting streamer properties are given as functions of "unbroken length". The well-known facts about streamers (e.g. that stepping occurs in lightning leaders, that the mean spark gradient becomes 5 kV/cm for long gaps, etc.) are dealt with. It is also pointed out that a streamer cannot cause any sensible temperature rise by itself, i.e. there can only be cold streamers. A.

551.594.221 : 538.566.2 : 538.561

THE CHARACTERISTIC ELECTRIC OSCILLATIONS OF THE CAVITY EARTH–AIR–IONOSPHERE EXCITED BY LIGHTNING FLASHES. See Abstr. 7206

551.594.5 : 550.385

THE THEORY OF MAGNETIC STORMS AND AURORAE. See Abstr. 7618

551.594.51 : 523.745

CHARACTERISTICS OF THE PROPERTIES OF CORPUSCULAR SOLAR EMISSION FROM THE SPECTRA OF AURORAE. See Abstr. 6595

TECHNIQUE. MATERIALS

621-229 : 548.1

JIGS FOR MAKING CRYSTALLOGRAPHIC WIRE MODELS. See Abstr. 6497

669.054

7641. REFINING TELLURIUM BY SUBLIMATION.
S.A.Semenkovich and N.N.Astashev.
Zh. tekh. Fiz., Vol. 28, No. 4, 725-31 (1958). In Russian.

The theoretical basis and the advantages of sublimation as a method of preliminary purification are discussed. A simple method is described, suitable for industrial application process, by which commercial grade Te (containing 98.5% Te, 0.05% Se, 0.1% Pb, 0.05% S, 0.06% S, 0.06% Si, 0.25% R_2O_3 and up to 15% Te oxides) was refined to yield a spectrographically pure product. The raw material was heated to 800° C and cast to produce ingots consisting of Se oxides tops, which were discarded, and metallic bottoms, which were remelted and cast into elongated ingots of trapezoidal cross-section. (By choosing this shape of the ingots the surface area of the charge and consequently the rate of sublimation was increased 2-3 times). Sublimation was carried out in vacuo at 370-380° C and had to be repeated twice to obtain the best results. For taking analytical samples the sublimate was divided into 5 zones of equal length. The highest purity material was found in zones II and III, counting from the lower end of the sublimate. Since Fe, Al, Pb, Si and Sb were concentrated in the top (V) zone of the sublimate, the authors conclude that these impurities sublime in the form of chlorides. M.H.Sloboda

677.01 : 551.510.42

ATMOSPHERIC POLLUTION AND THE SOILING OF TEXTILE MATERIALS. See Abstr. 7622

PHOTOGRAPHY

77.023.7 : 539.1.07

ON THE CLEARING OF EMULSION PLATES. See Abstr. 6107

771.534 : 522.61

THEORETICAL CONSIDERATIONS REGARDING THE CHOICE OF PHOTOGRAPHIC PLATES FOR SPECTROPHOTOMETRY. See Abstr. 6573

778.34 : 539.1.07

7642. DETERMINATION OF THE CONCENTRATION OF AN ELEMENT INTRODUCED BY ABSORPTION IN A NUCLEAR EMULSION. G.Mayr.
Ricerca sci., Vol. 28, No. 5, 985-93 (May, 1958). In Italian.

The concentration is found by a modification of tracer methods. L.Pincherle

778.5 : 621.389

7643. A METHOD OF FLASH SYNCHRONIZATION FOR HIGH-SPEED CINEMATOGRAPHY. J.D.Lewis and G.T.Peck.
J. sci. Instrum., Vol. 35, No. 9, 338-40 (Sept., 1958).

A description is given of the method used to synchronize a high-power stroboscope for use as the light source for high-speed cinematography. The essential requirements which had to be met were that the camera modifications should be kept to a minimum and that the synchronization should be effective over a speed range from 200 to 8000 frames/sec. A.

LIST OF JOURNALS

The following list supplements the List of Journals published with the June number of Volume 60 (1957) and the Supplement published with the Index to the same volume. Reprints of the List of Journals and of the Supplement can be obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.

The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

J. Inst. Navig. — Journal of the Institute of Navigation.
Publisher: John Murray, 50 Albemarle Street, London, W.1.

Smithsonian Contrib. Astrophys. — Smithsonian Contributions to Astrophysics.
Smithsonian Institution, Washington, D.C. Obtainable from: The Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

Vestnik Akad. Nauk SSSR — Vestnik Akademii Nauk SSSR.
Cherkasskiĭ per 2, Moscow.

NEW JOURNAL

Siemens Edison Swan J. — Siemens Edison Swan Journal.
155 Charing Cross Road, London, W.C.2.
Vol. 1 dated Summer, 1958. Replaces, in a more comprehensive form:
Siemens Engineering Bulletin.

NOTE

Siemens Engng Bull. — Siemens Engineering Bulletin.
Replaced by: Siemens Edison Swan Journal [Siemens Edison Swan J.]

ERRATA

Author Index (1957) p. 1040, column 1 : for "Toraldi di Francia,G." read "Toraldo di Francia,G."
Abstr. 5611 (1958) line 7 : for "Bohn" read "Bohm".
Abstr. 6109 (1958) line 1 : for "LINED" read "LIVED".

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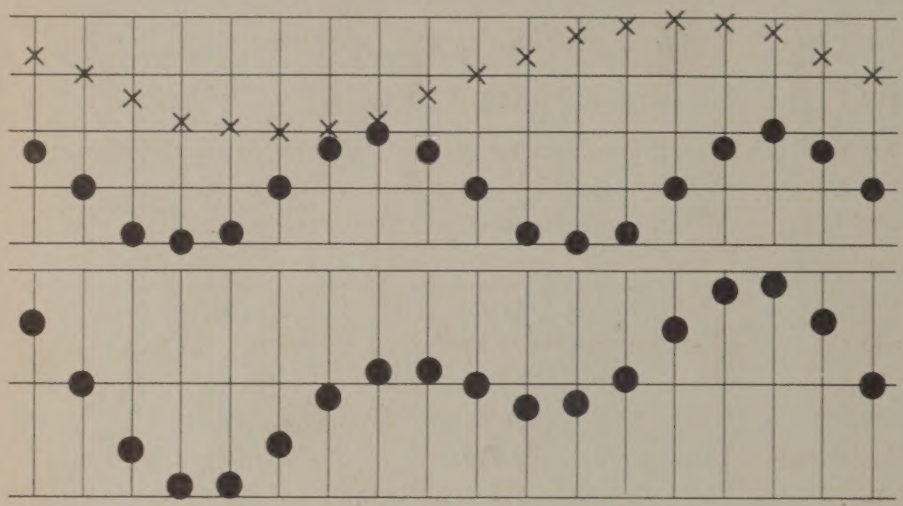
Announcing A New Set of **Welch** Film Loops on Wave Motion

Made from original films produced by Dr. John J. Heilemann, Professor of Physics, Ursinus College, Collegeville, Pa.

Illustration of one frame of Loop 4 "Sum of Two Waves of Different Frequency"



Two component waves (upper portion) having the same velocity and amplitude and with frequencies in the ratio 2: 1 combine to show the familiar resultant wave-shape (lower portion) associated with a musical note and its octave. The wave form does not change and has the velocity of its components. The distinction between "simple" and "complex" harmonic motion may be made by observing any set of three particles on a vertical line; the particles in the component waves are executing simple harmonic motion while the resultant executes a complex harmonic motion.

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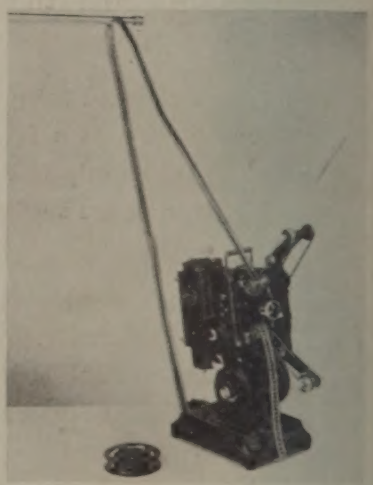

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